No. 745,867. PATENTED DEC. 1, 1903.

W. H. LANG.

NAIL MAKING AND DRIVING MACHINE.

APPLICATION FILED FEB. 27, 1900.

NO MODEL. 12 SHEETS—SHEET 1.

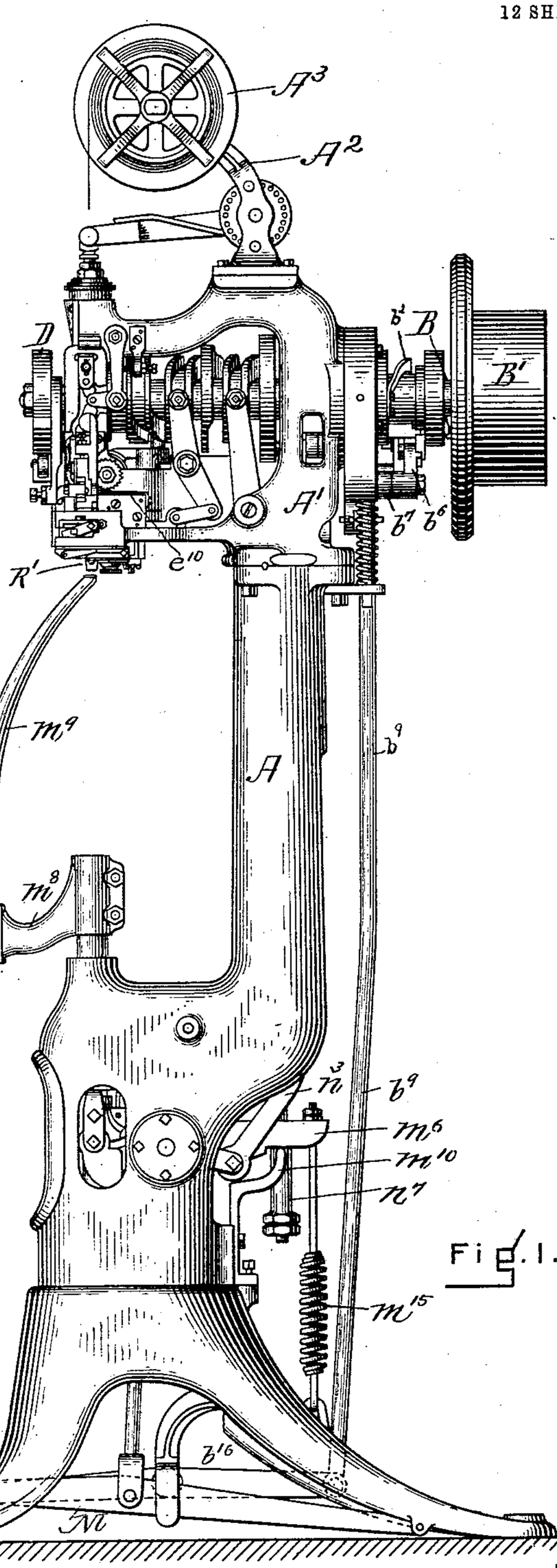

Fig. 1.

WITNESSES:
J. M. Dalton
M. D. Newman.

INVENTOR:
Wm. H. Lang
by his attys
Clarke & Raymond

No. 745,867. PATENTED DEC. 1, 1903.

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NAIL MAKING AND DRIVING MACHINE.

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NO MODEL. 12 SHEETS—SHEET 2.

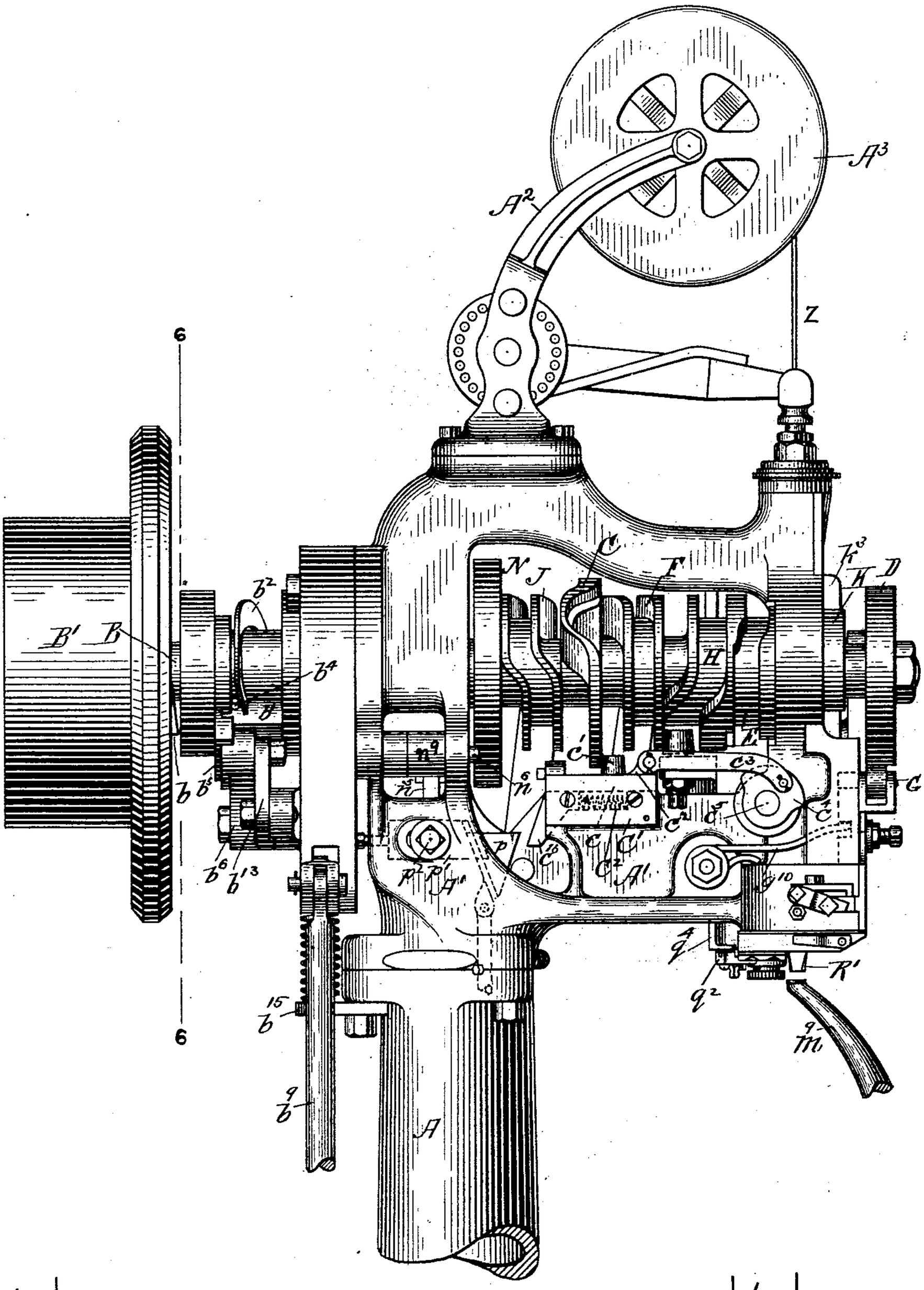

Fig. 2.

WITNESSES
L. M. Dolan
M. D. Newman

INVENTOR:
Wm. H. Lang
by his attys
Clarke & Raymond

No. 745,867. PATENTED DEC. 1, 1903.

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NO MODEL. 12 SHEETS—SHEET 3.

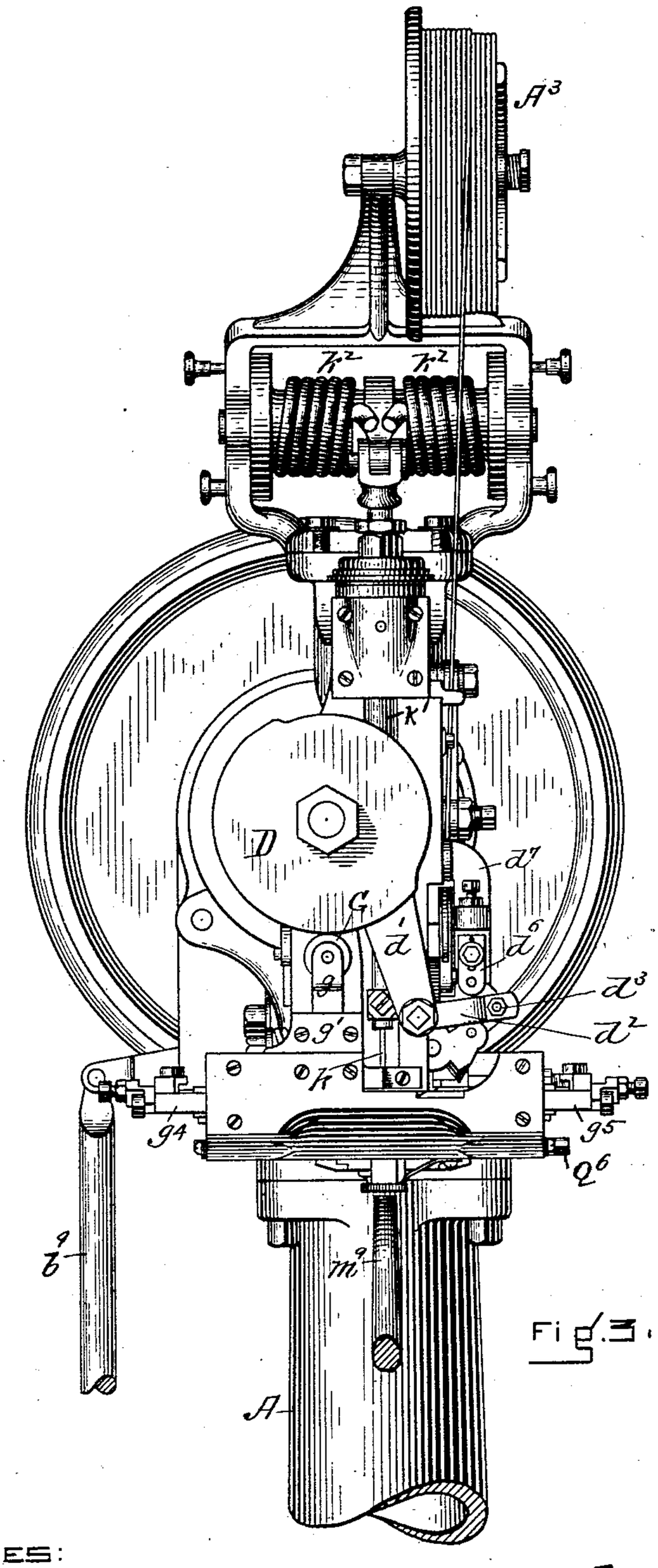

Fig. 3.

WITNESSES:
L. M. Dolan.
M. D. Newman.

INVENTOR:
Wm. H. Lang
by his attys
Clarke & Raymond

No. 745,867. PATENTED DEC. 1, 1903.

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NAIL MAKING AND DRIVING MACHINE.

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NO MODEL. 12 SHEETS—SHEET 4.

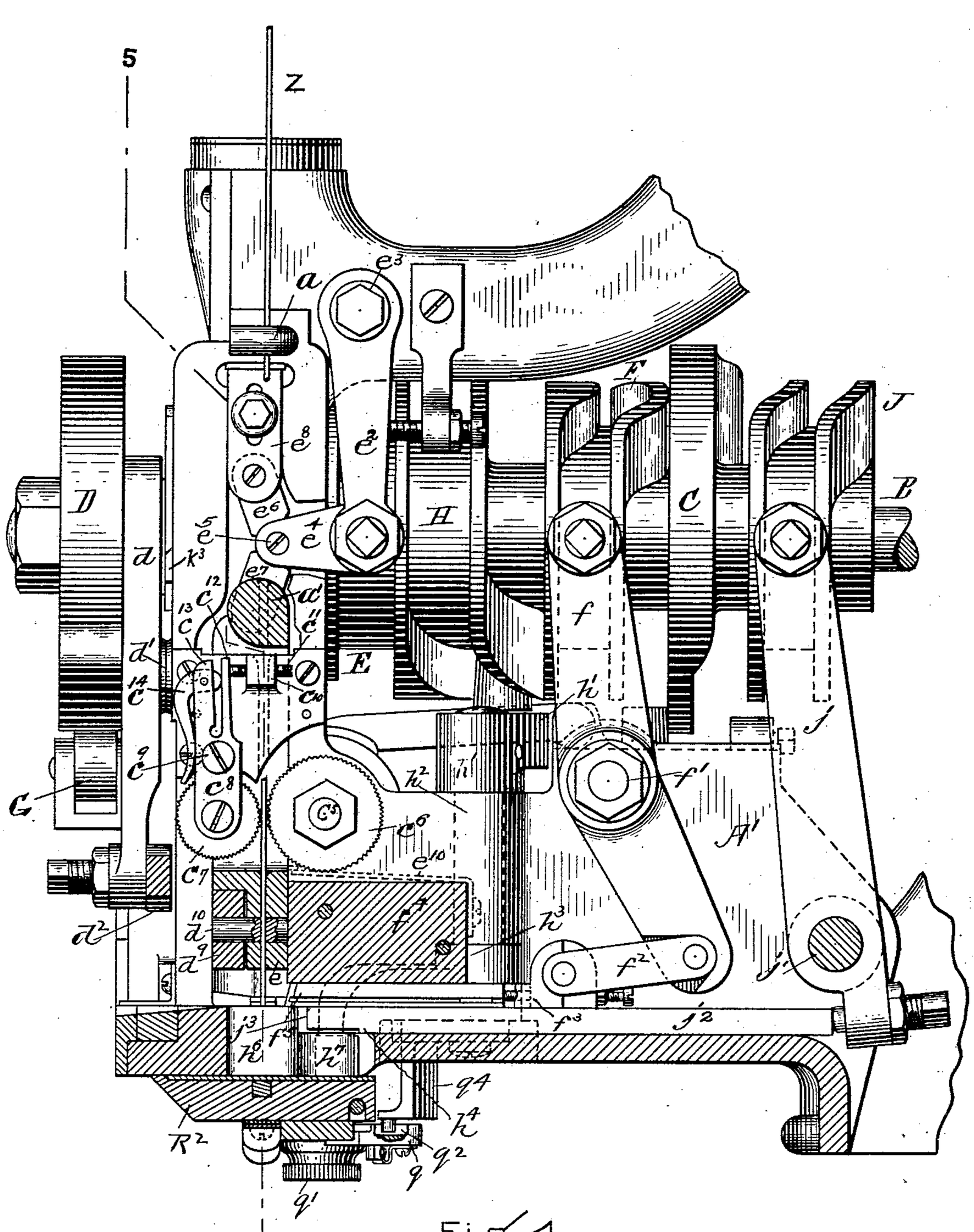

Fig. 4.

WITNESSES:
L. M. Dolan.
M. D. Newman.

INVENTOR:
Wm. H. Lang
by his Attys
Clarke & Raymond

No. 745,867. PATENTED DEC. 1, 1903.

W. H. LANG.

NAIL MAKING AND DRIVING MACHINE.

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NO MODEL. 12 SHEETS—SHEET 5.

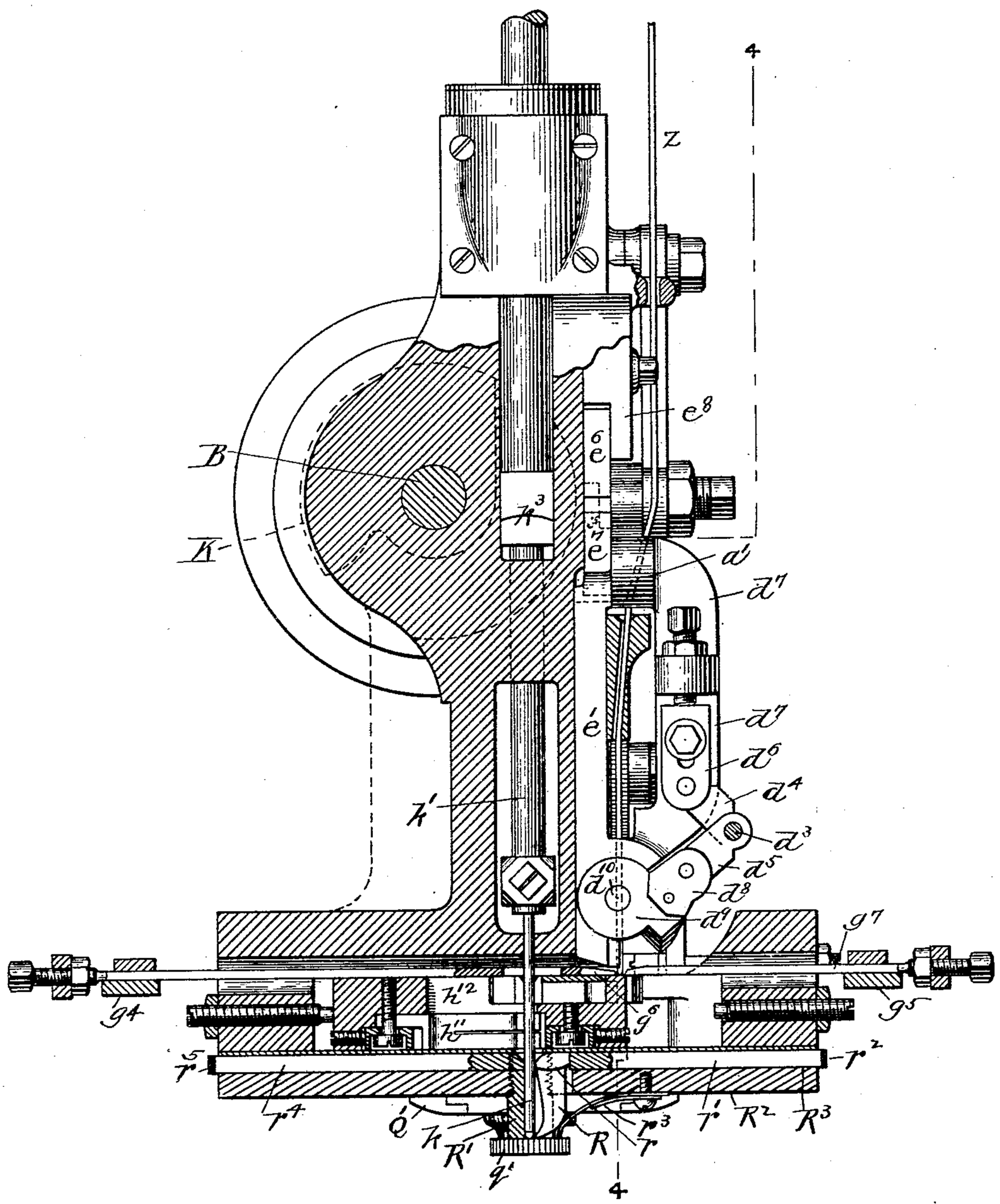

Fig. 5.

WITNESSES:
L. M. Dolan.
M. D. Newman

INVENTOR:
Wm. H. Lang
by his Attys
Charles & Raymond

No. 745,867. PATENTED DEC. 1, 1903.

W. H. LANG.

NAIL MAKING AND DRIVING MACHINE.

APPLICATION FILED FEB. 27, 1900.

NO MODEL. 12 SHEETS—SHEET 6.

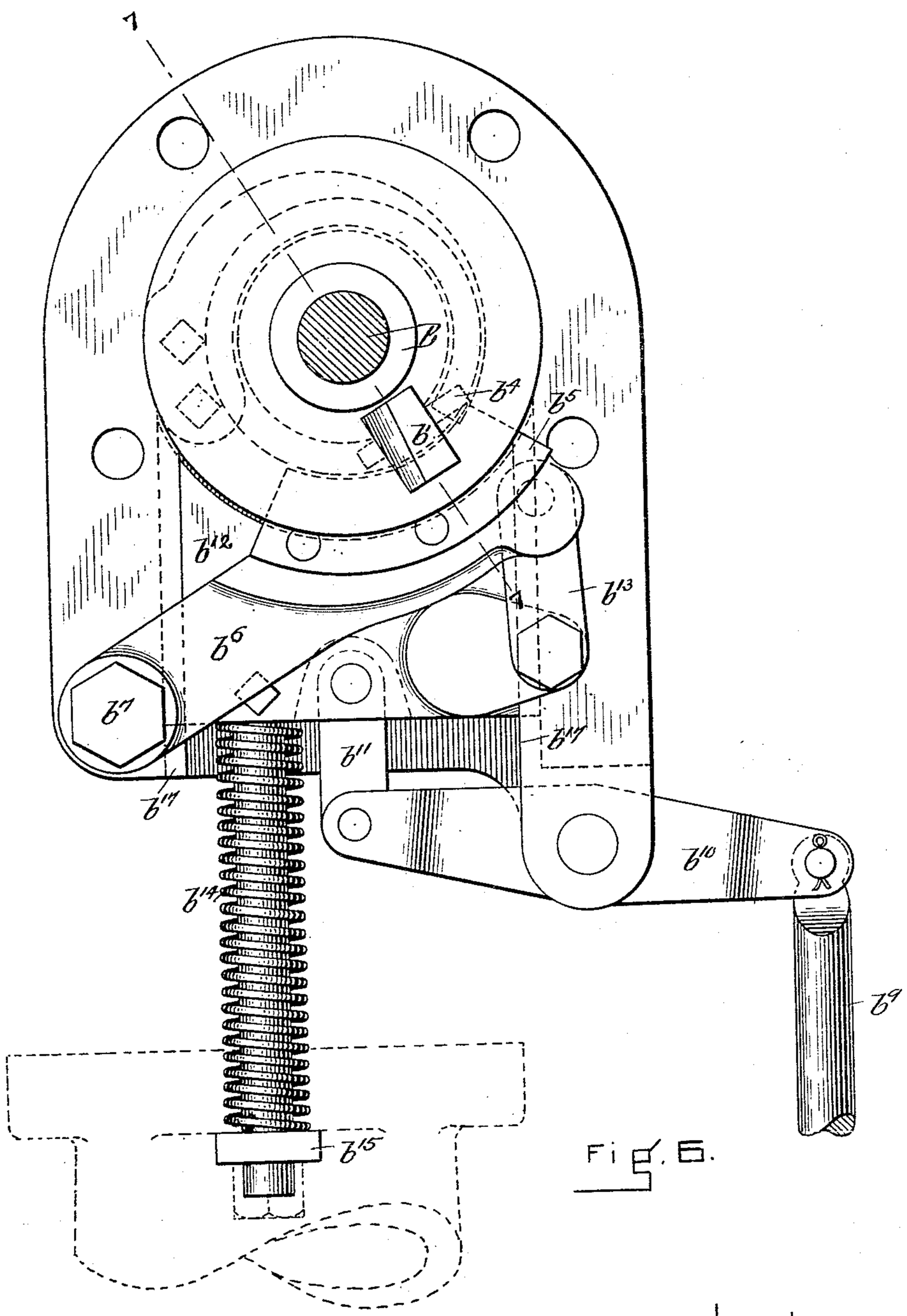

Fig. 6.

WITNESSES:
L. M. Dolan.
M. D. Newman

INVENTOR:
Wm. H. Lang
by his attys
Clarke & Raymond

No. 745,867. PATENTED DEC. 1, 1903.

W. H. LANG.

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NO MODEL. 12 SHEETS—SHEET 7.

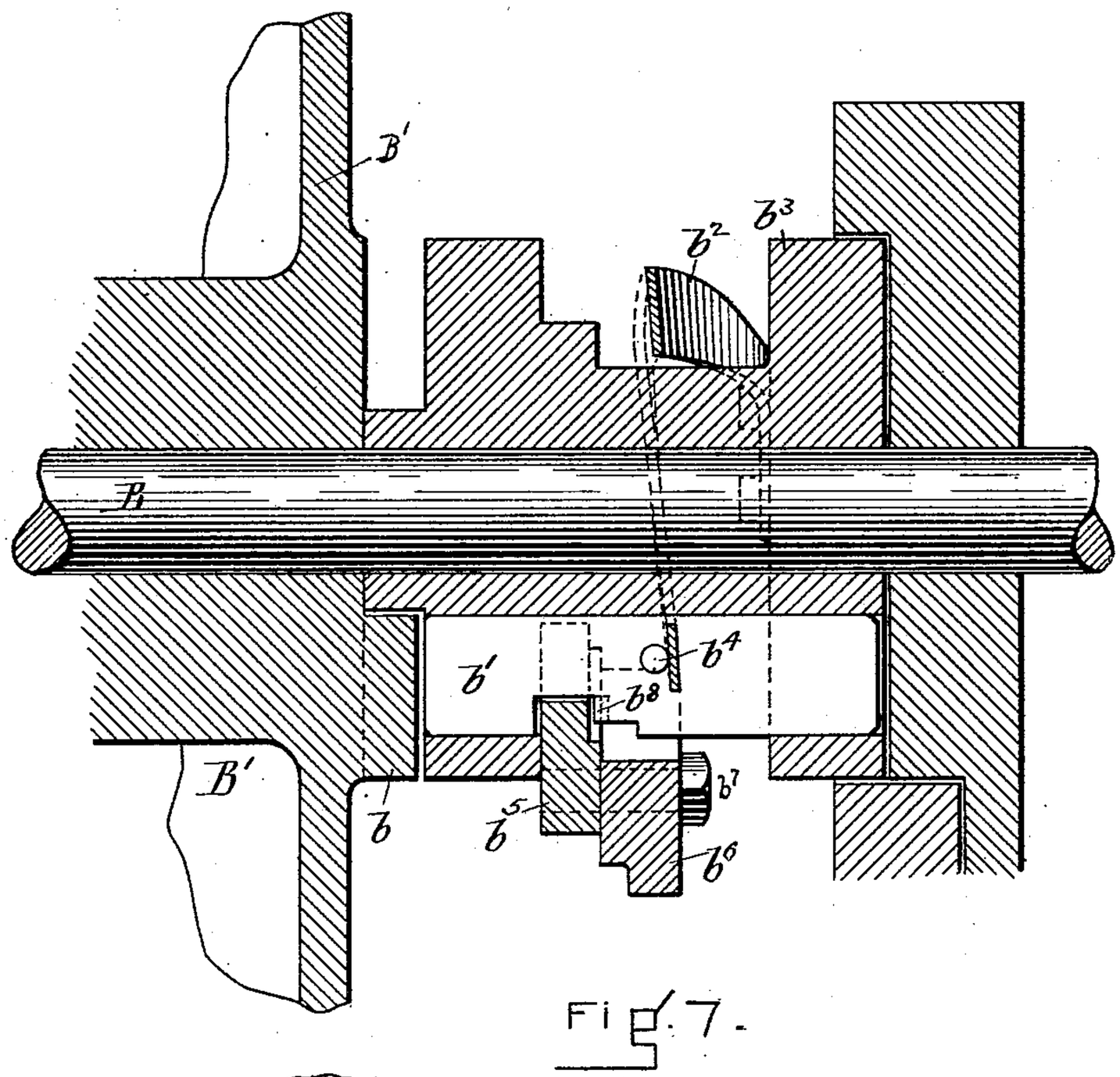


Fig. 7.

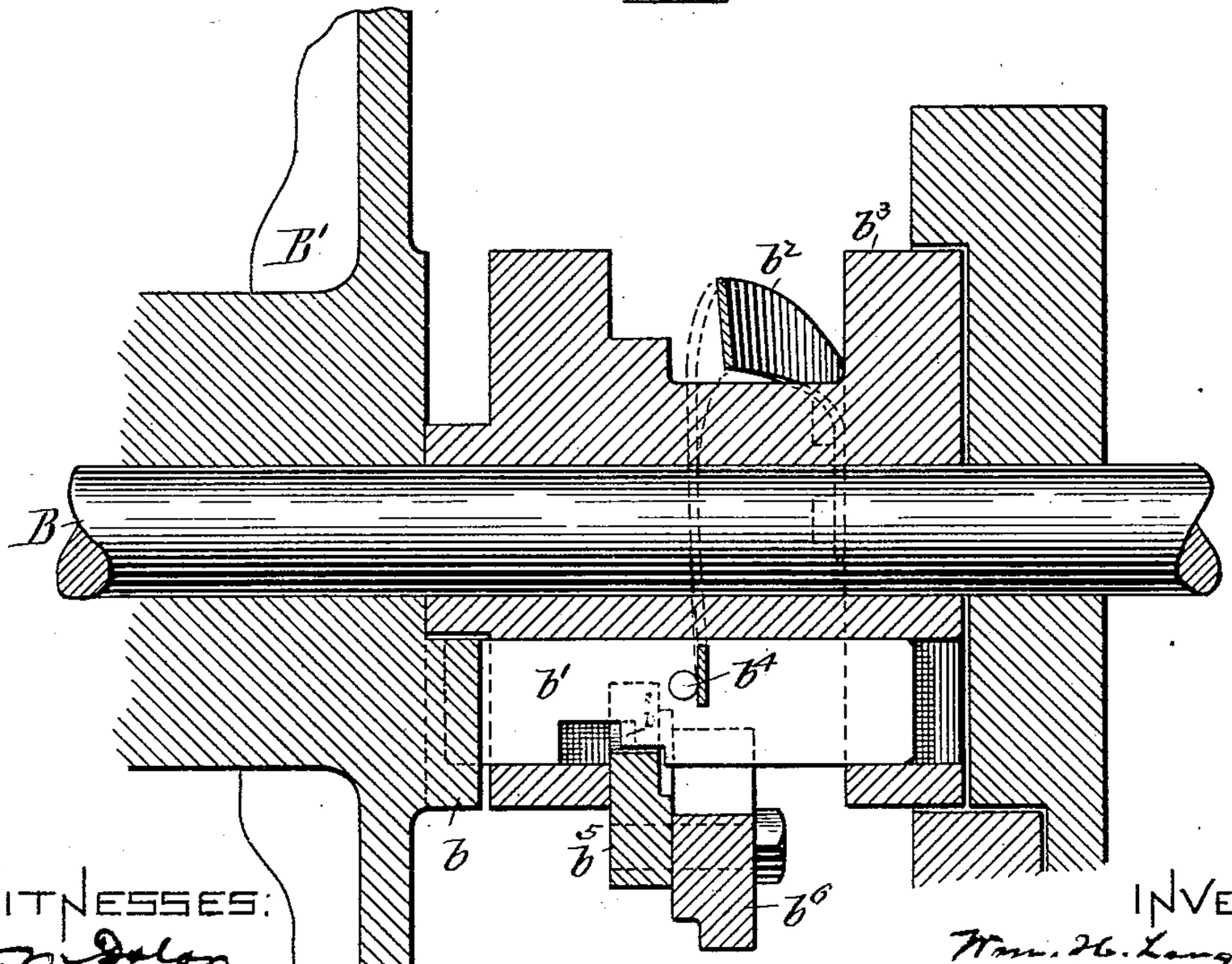


Fig. 8.

WITNESSES:
L. M. Dolan.
M. D. Newman

INVENTOR:
Wm. H. Lang
by his Attys
Clarke & Raymond

No. 745,867. PATENTED DEC. 1, 1903.

W. H. LANG.

NAIL MAKING AND DRIVING MACHINE.

APPLICATION FILED FEB. 27, 1900.

NO MODEL. 12 SHEETS—SHEET 8.

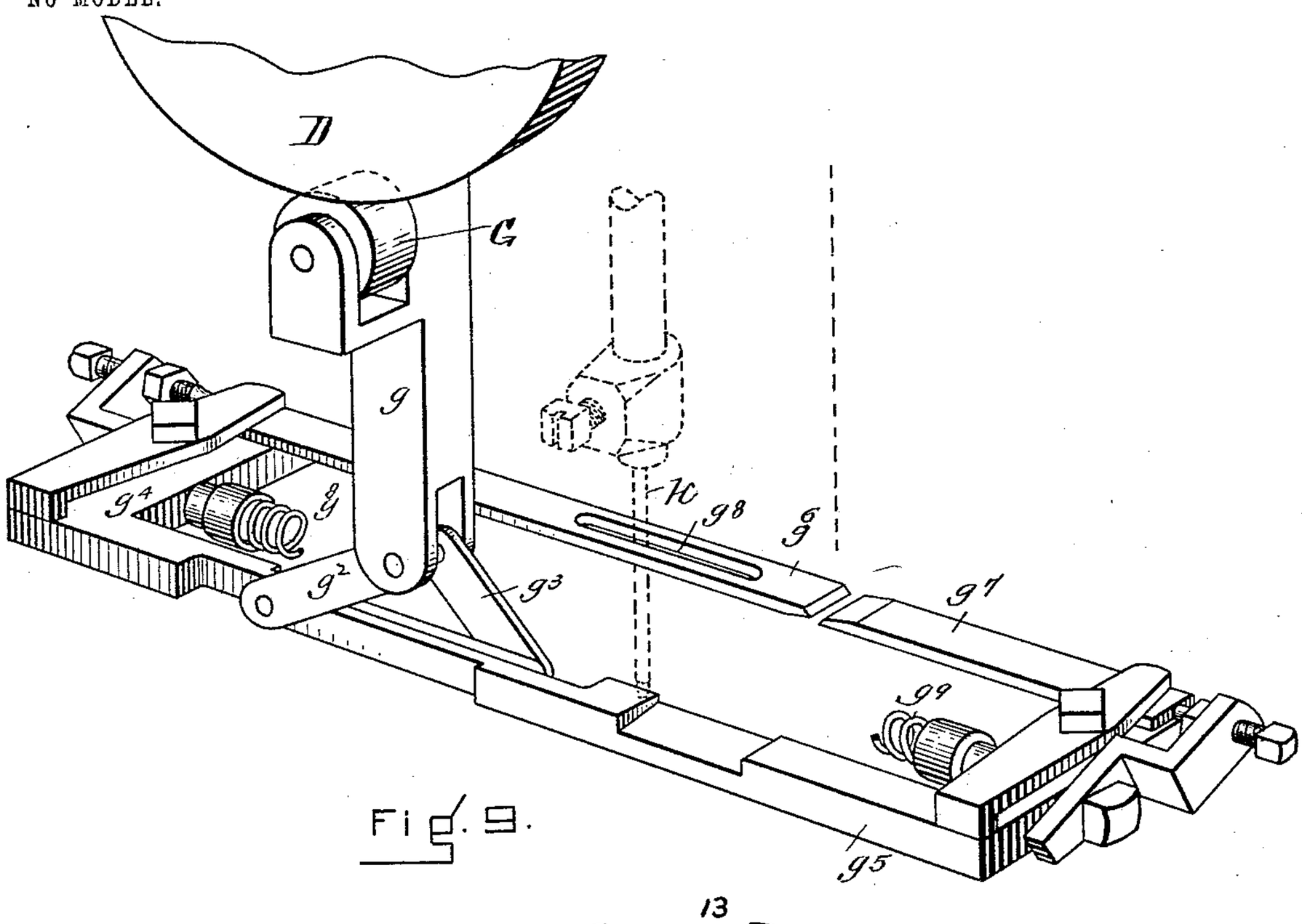


Fig. 9.

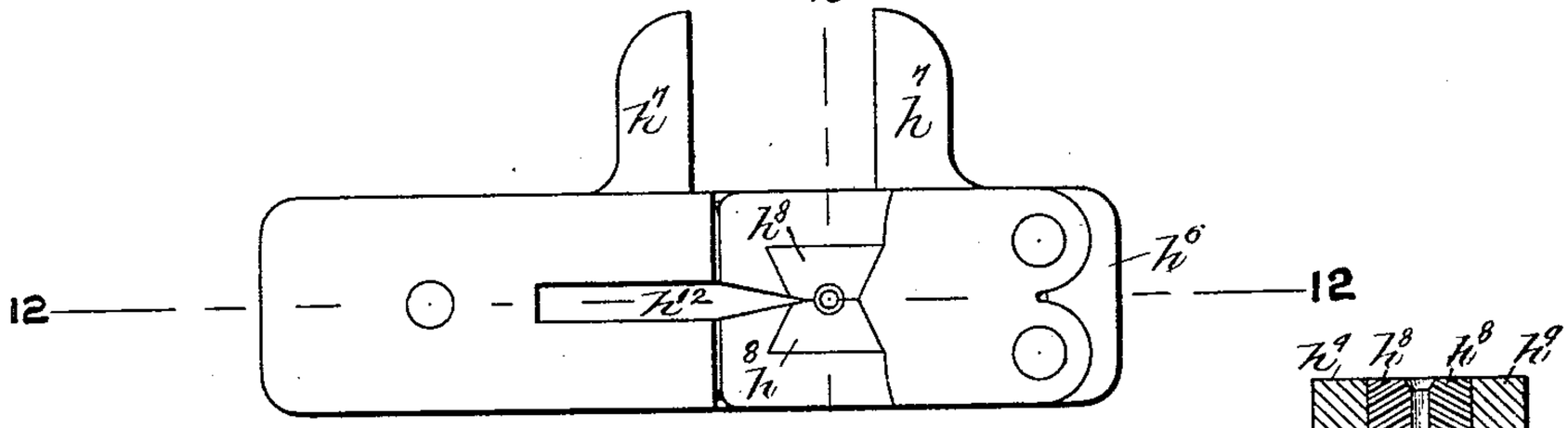


Fig. 10.

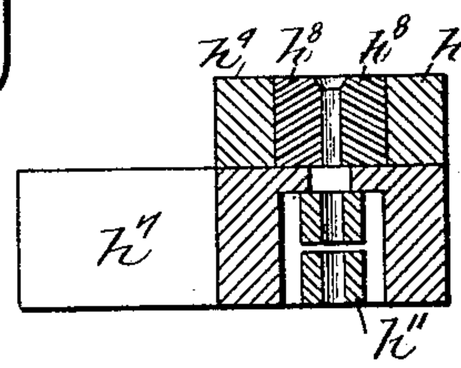


Fig. 13.

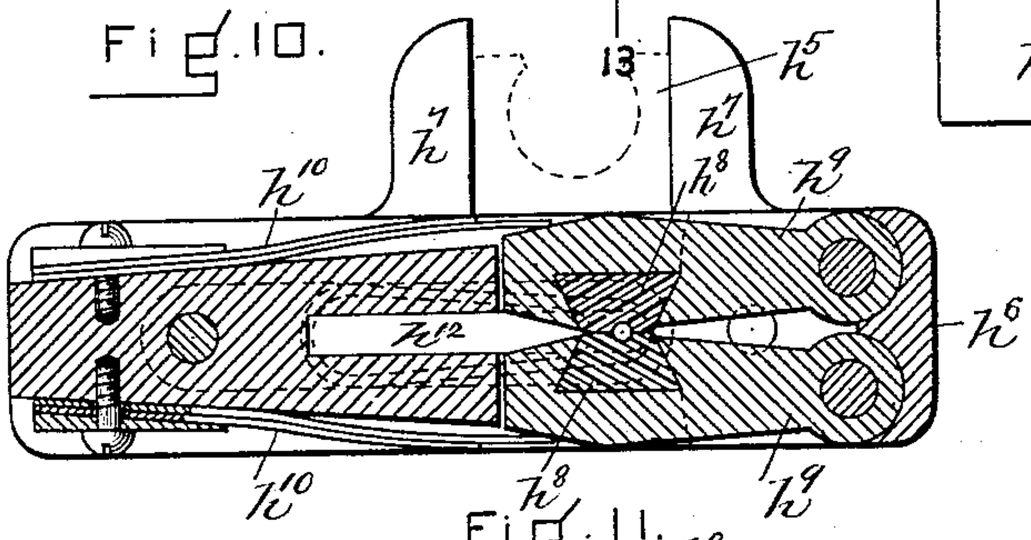


Fig. 11.

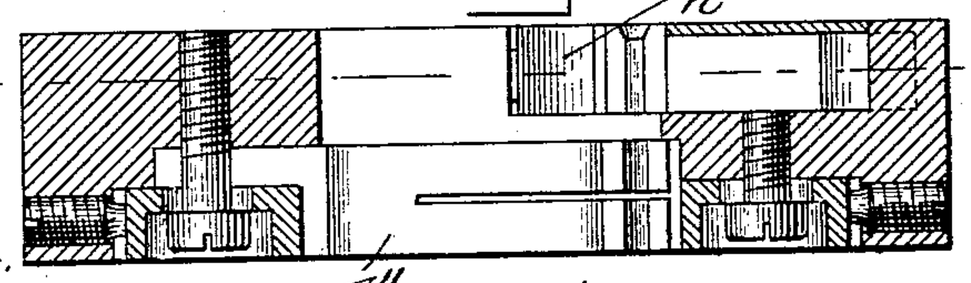


Fig. 12.

WITNESSES:
L. M. Dolan.
M. D. Newman.

INVENTOR:
Wm. H. Lang
by his attys
Church & Raymond.

No. 745,867. PATENTED DEC. 1, 1903.

W. H. LANG.

NAIL MAKING AND DRIVING MACHINE.

APPLICATION FILED FEB. 27, 1900.

NO MODEL. 12 SHEETS—SHEET 9.

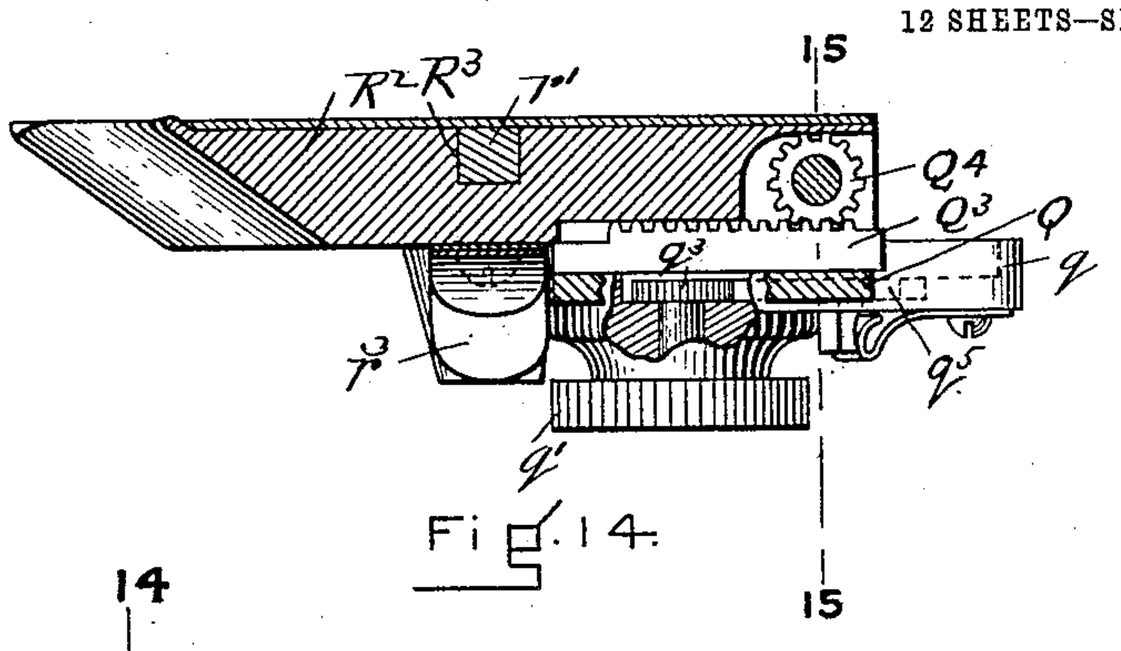


Fig. 14.

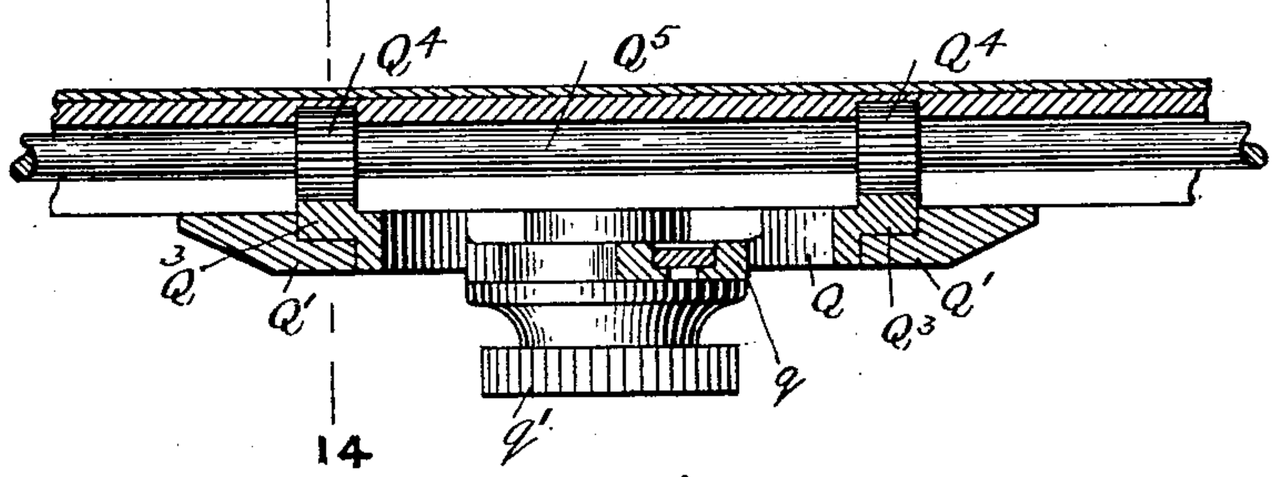


Fig. 15.

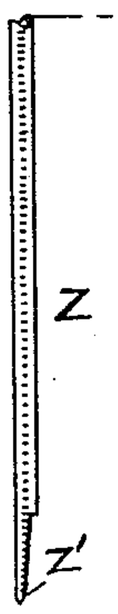


Fig. 16.

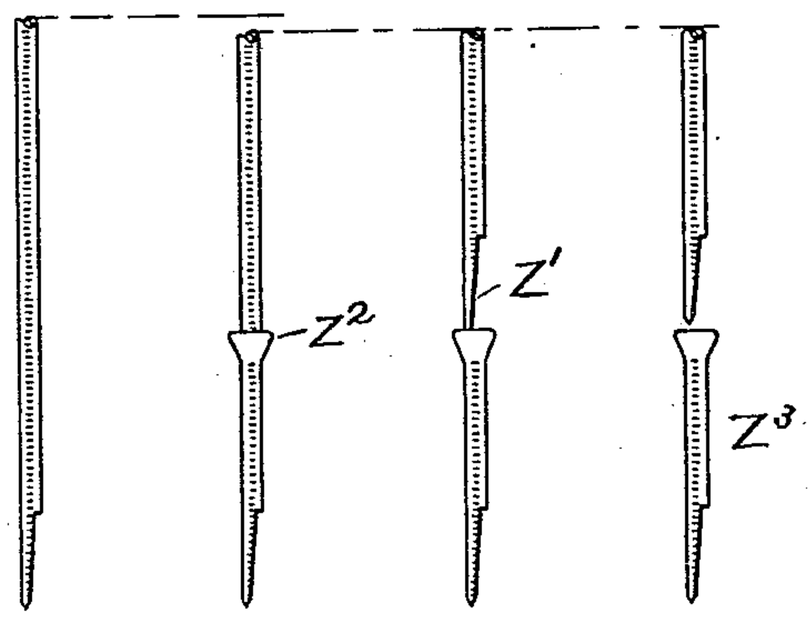
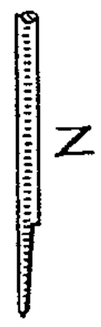


Fig. 17. Fig. 18. Fig. 19. Fig. 20.



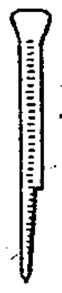


Fig. 21.

WITNESSES:
L. M. Dalson.
M. D. Newman

INVENTOR:
Wm. H. Lang
by his attys
Clarke & Rays and

No. 745,867. PATENTED DEC. 1, 1903.

W. H. LANG.

NAIL MAKING AND DRIVING MACHINE.

APPLICATION FILED FEB. 27, 1900.

NO MODEL. 12 SHEETS—SHEET 10.

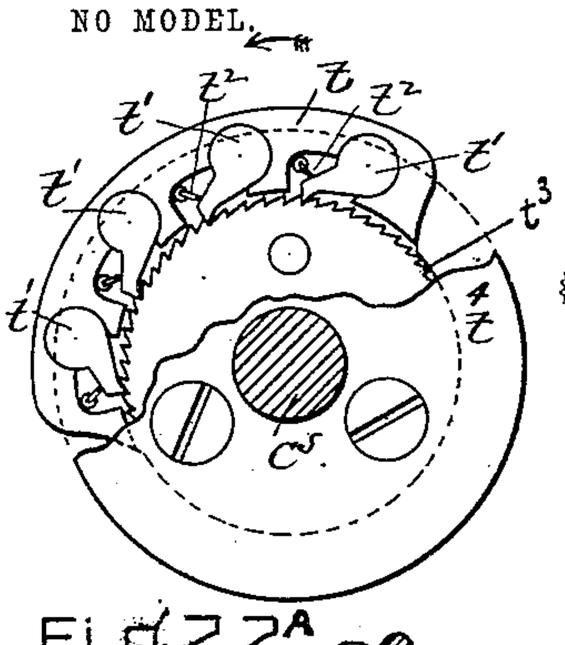


Fig. 22A

Fig. 22.

WITNESSES:
D. M. Dolan.
H. D. Newman

INVENTOR:
Wm. H. Lang
by his attys
Clarke & Raymond

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 745,867. PATENTED DEC. 1, 1903.

W. H. LANG.

NAIL MAKING AND DRIVING MACHINE.

APPLICATION FILED FEB. 27, 1900.

NO MODEL. 12 SHEETS—SHEET 11.

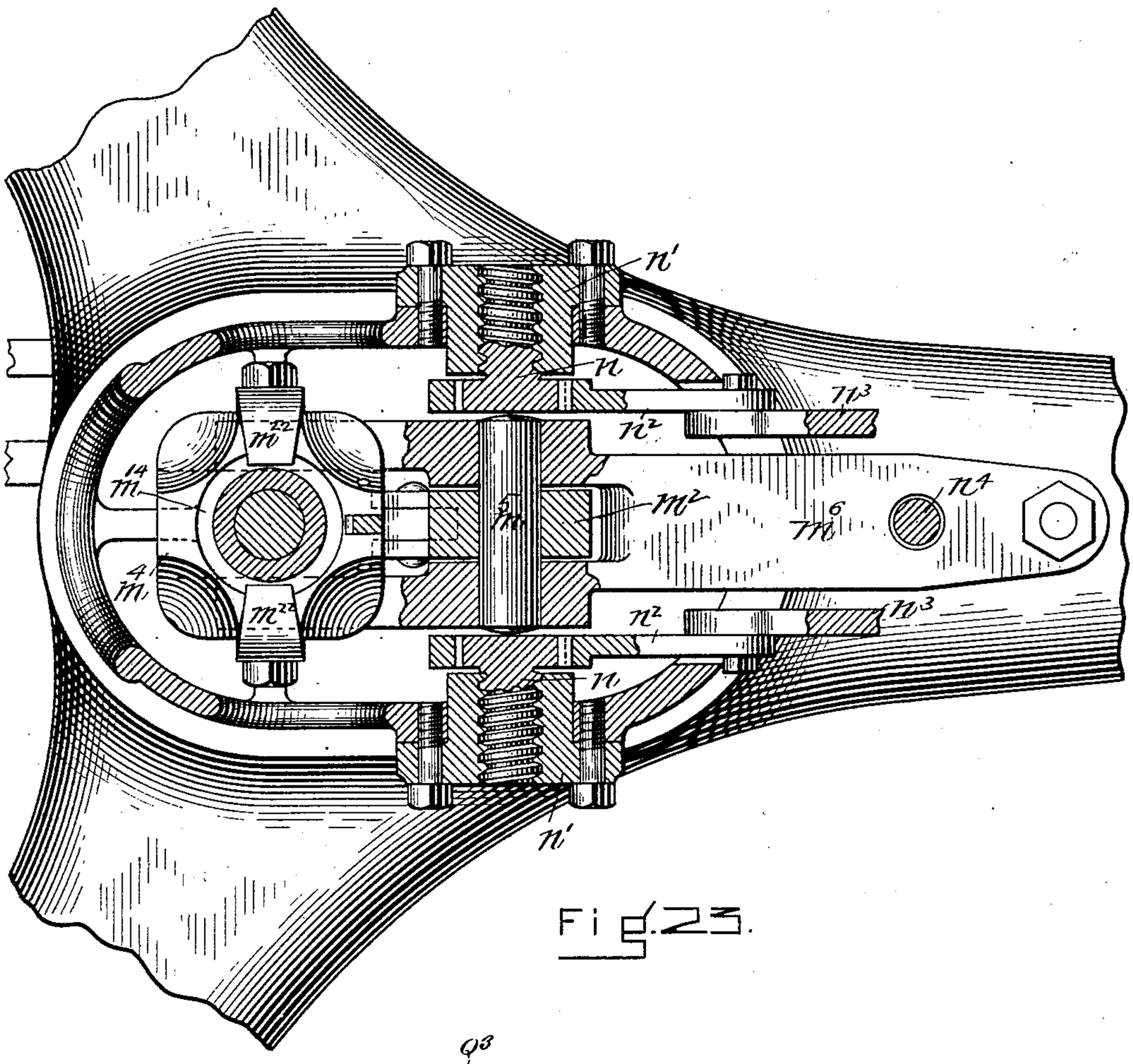


Fig. 25.

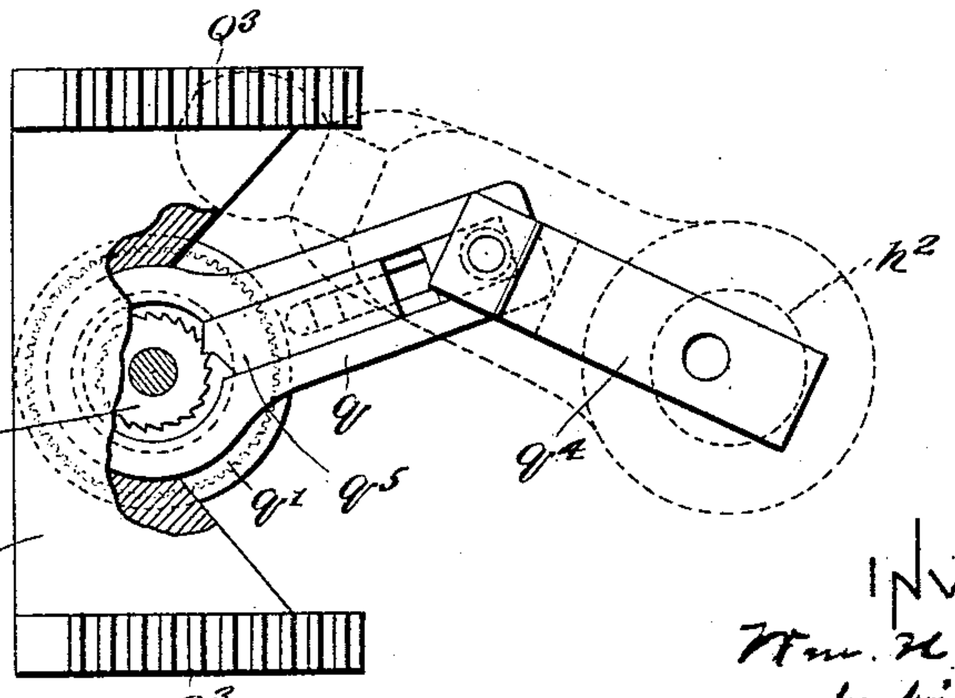


Fig. 26.

WITNESSES:

J. M. Dolan.

M. D Newman

INVENTOR:

Wm. H. Lang

by his attys

Clarke & Raymond

No. 745,867. PATENTED DEC. 1, 1903.

W. H. LANG.

NAIL MAKING AND DRIVING MACHINE.

APPLICATION FILED FEB. 27, 1900.

NO MODEL. 12 SHEETS—SHEET 12.

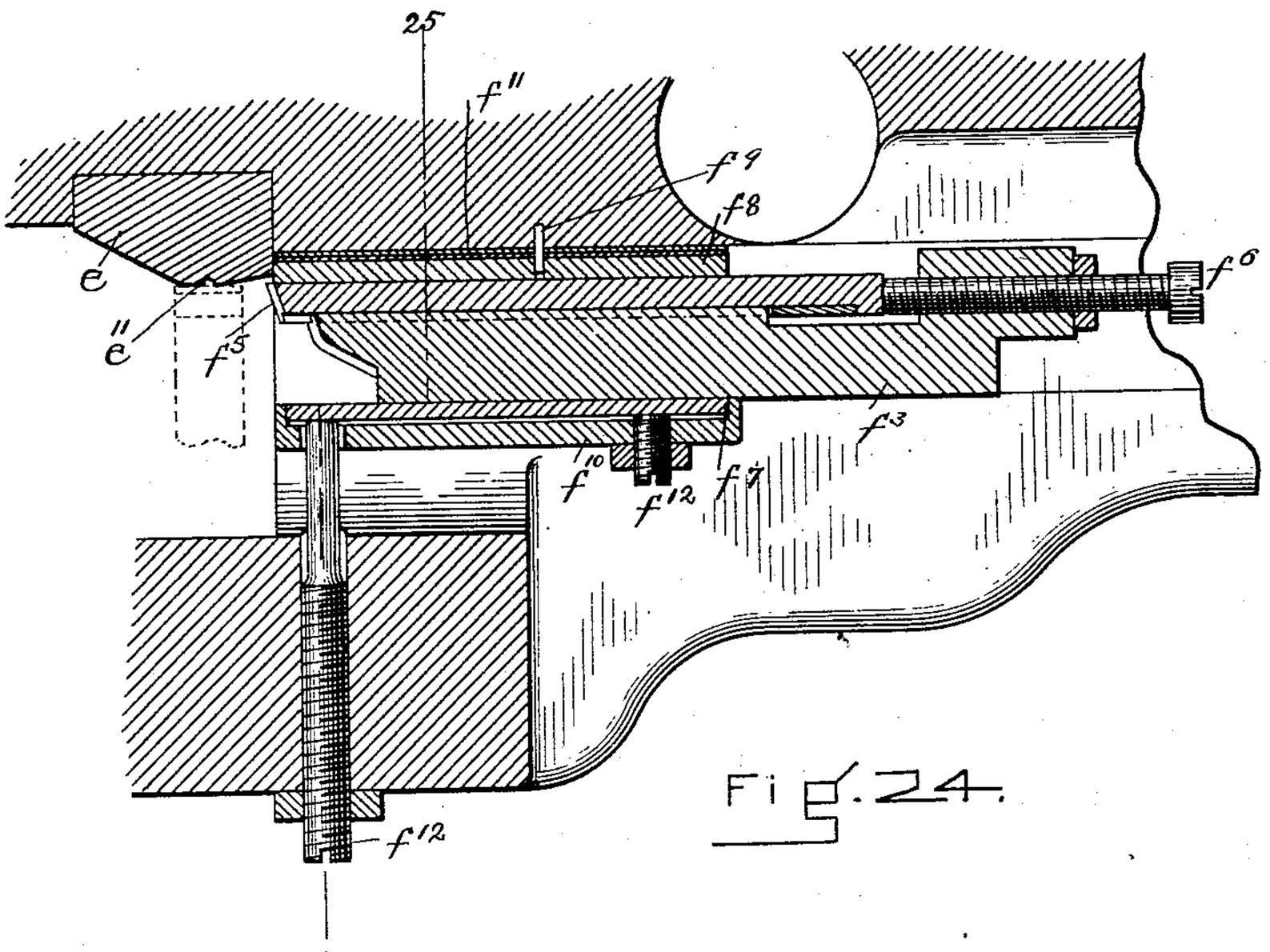


Fig. 24.

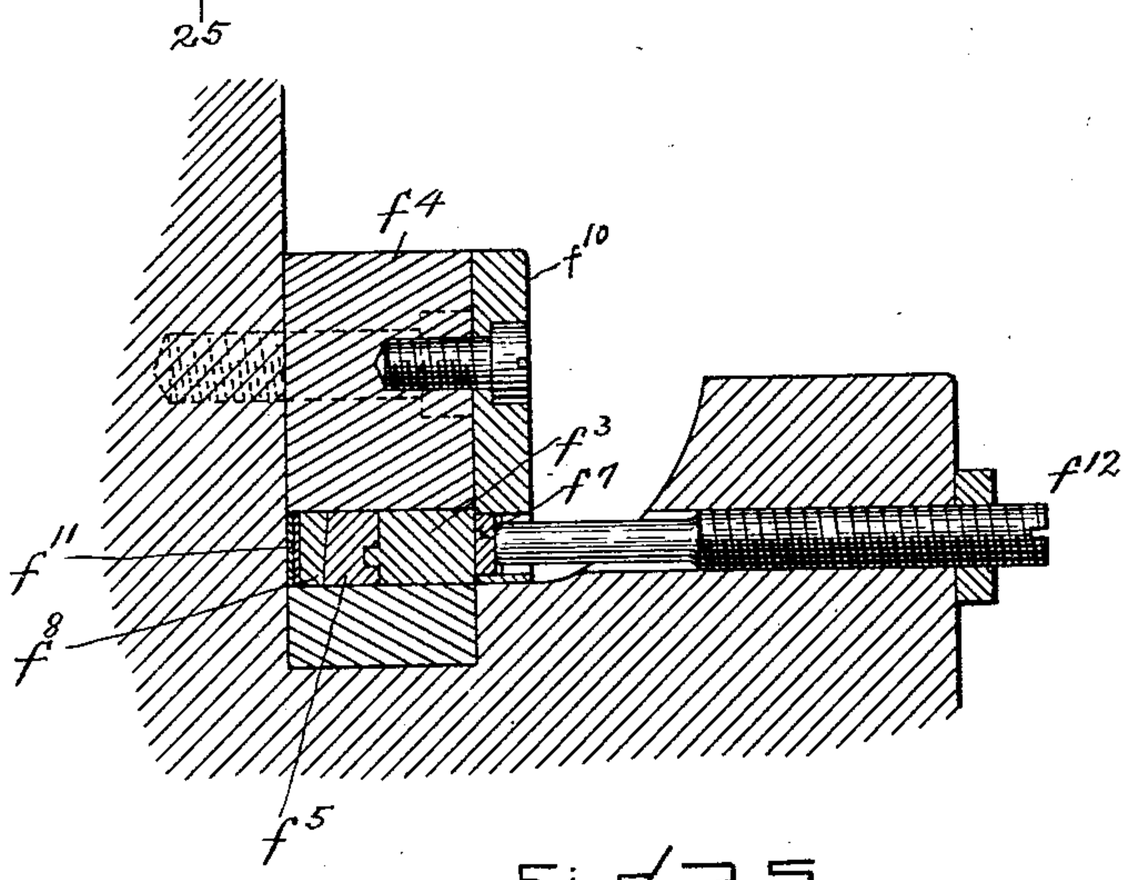


Fig. 25.

WITNESSES:
J. M. Dolan.
H. D. Newman.

INVENTOR:
Wm. H. Lang
by his attys
Clarke & Raymond

No. 745,867. Patented December 1, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM H. LANG, OF BURLINGTON, VERMONT, ASSIGNOR TO THE SUFFOLK NAILING MACHINE COMPANY OF PORTLAND, MAINE, OF BURLINGTON, VERMONT, A CORPORATION OF MAINE.

NAIL MAKING AND DRIVING MACHINE.

SPECIFICATION forming part of Letters Patent No. 745,867, dated December 1, 1903.

Application filed February 27, 1900. Serial No. 6,660. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. LANG, a citizen of the United States, and a resident of Burlington, in the county of Chittenden and State of Vermont, have invented a new and useful Improvement in Nail Making and Driving Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

My invention relates to that class of nailing-machines in which the nail is made and cut from a continuous strip of wire carried by the machine and is then driven into the article to be nailed, which is suitably supported for the purpose and is fed automatically after each nailing operation.

My invention is an improvement upon the machine described in Letters Patent of the United States No. 566,359, granted to Weeks and Tuttle August 25, 1896, the improvements relating mainly to the details of construction of certain portions of that machine whereby the shape of the nail is improved materially and the means for handling it are also made more effective.

I have shown my invention applied to shoe-work, for it is especially adapted for that purpose.

My invention will be understood by reference to the drawings, in which—

Figure 1 represents a side elevation of a machine embodying my present invention, Fig. 2 being a side elevation of the head carrying the nail making and driving mechanism, this view being taken from the other side of the machine from that shown in Fig. 1. Fig. 3 is a front elevation of the head. Fig. 4 is an enlargement of a portion of the head, taken from the side shown in Fig. 1, said view being partly in section. Fig. 5 is a section taken on line 5 5 of Fig. 4. Fig. 6 is a view taken on line 6 6 of Fig. 2. Fig. 7 is a section on line 7 7 of Fig. 6, showing the clutch mechanism, Fig. 8 being a similar view, the parts being in different position. Fig. 9 is a detail in perspective, showing the cutter mechanism. Fig. 10 is a plan of the nail-carriage. Fig. 11 is a section on line 11 of Fig. 12. Fig. 12 is a section on line 12 12 of Fig. 10. Fig. 13 is a section on line 13 13 of Fig. 10. Figs. 14 and 15 relate to the shoe-feeding mechanism, Fig. 14 being a section on line 14 14 of Fig. 15, and Fig. 15 a section on line 15 15 of Fig. 14. Figs. 16 to 21 represent the different steps in a nail-cutting operation, the views being arranged upon the sheet diagrammatically to indicate the amount of vertical movement of the feed and also the amount and character of horizontal movement of the nails. Fig. 22 is a vertical section of the standard or post which supports the head, showing the interior construction thereof. Fig. 22^A is a detail of c^4, Fig. 2. Fig. 23 is an enlarged sectional view looking down into the post and showing a portion of the mechanism for controlling the length of the wire-feed from the horn which supports the shoe. Figs. 24 and 25 are sectional details showing the arrangement of the slicing-knife whereby it may be adjusted to compensate for wear both at its point and its slide. Fig. 26 is a plan view of the shoe-feeding mechanism.

A represents the standard or post which supports the head A′, carrying the cam-shaft B and the parts operated thereby to feed the wire, form the nail, and drive it.

My machine may be better understood by first considering the work which it is to do. For this purpose brief reference is had to Figs 16 to 21, inclusive. While the necessities of drafting require that these views be placed side by side, they may be considered as superimposed, the wire in each case remaining in the same vertical line. The difference between the position of the point of the wire in Fig. 16 and its position in Fig. 17 indicates approximately the length of vertical feed given to the wire, and the difference between the level of the upper end of the wire in Fig. 17 and of the upper end of the wire in Fig. 18 indicates the amount of wire upset into the head. The lateral distance between the wire in Fig. 21, and the finished nail represents approximately the lateral movement given to the nail after it has been cut from the wire and is moved under the driver. Fig. 16 represents a wire Z from which a nail has just been cut, showing also that the narrow-

ing and pointing of the wire to form the point of the nail to be made has already taken place, as at Z'. The wire is first fed downward from the position shown in Fig. 16 to the position shown in Fig. 17. The next step is the forming of the head Z^2, as shown in Fig. 18; next, the narrowing of the point Z' for the next nail, as shown in Fig. 19; next, the cutting off of the nail Z^3, thus shaping the point, as shown in Fig. 20, and leaving the wire in the position shown in Fig. 16 ready to be fed again, and, next, Fig. 21, the carrying of the nail which has been cut off into position under the driver, where Z indicates the wire from which the nail has been cut, in position to be fed vertically to make the next nail, and Z^3 the nail which has been cut from it and has been carried into position under driver. These various steps being indicated, the mechanisms for carrying them out will now be described.

Upon the frame A' there is carried an arm A^2, upon which is mounted a reel A^3, having upon it the supply of wire, this mechanism and its mounting being substantially that of the Weeks and Tuttle patent above referred to, and hence not needing any further description. From this reel A^3 the wire Z is carried down through an eye in a boss a and through a second eye or passage a' in the piece d^7 and between a tension-roll c^7 and the feed-roll c^6, which is operated in a manner now to be described to move the wire from which the nail has been cut (see Fig. 16) into the position shown in Fig. 17.

C is the feed-cam, mounted on the cam-shaft B. On the frame A' of the machine is a housing C', containing a slideway in which is mounted a slide c, carrying a cam-pin c', which bears against the front edge of the cam C and is held against it by the spring C^2, lying in the housing below the slide c, so that it will be compressed during the forward movement of the slide and in expanding will force the slide rearward, so that the cam-pin c' will remain in contact with the cam-surface unless it is stopped by some obstruction. This slide also carries an eye c^2, by means of which and a link c^3 it is connected with a disk c^4 on the shaft c^5. The disk c^4 is loose on the shaft and may be connected with the shaft c^5 in any suitable manner—as, for example, by a pawl-and-ratchet mechanism (see Fig. 22^A)—whereby the forward movement of the slide will give a rotary movement to the shaft c^5, while the rearward movement of the slide will have no effect upon the shaft. The shaft c^5 passes through bearings in the frame and at its farther end carries the feed-roll c^6, c^7 being a tension-roll opposite the feed-roll c^6 and adapted to hold the wire Z in contact with it. For this purpose it should be provided with suitable devices for adjusting its position in relation to the feed-roll so as to force the wire against the feed-roll.

The adjusting devices shown in the drawings are as follows: The roll c^7 is carried by the lower end of a plate c^8, pivoted to the frame A' at c^9. Upon the frame is a boss c^{10}, carrying a screw c^{11}, one end of which bears against the upper end of the plate c^8. The position of this screw c^{11} determines generally the position of the lower end of the plate c^8, and hence the position of the tension-roll c^7, with relation to the feed-roll c^6. In addition, as it is desirable that the tension-roll shall hold the wire against the feed-roll with a yielding contact I prefer to split the upper end of the plate c^8 into two parts c^{12} and c^{13}, the thin part c^{12} forming a spring and bearing against one end of the screw c^{11}, the other part c^{13} carrying a spreading or cam lever c^{14}, pivoted therein, adapted to separate the parts c^{12} and c^{13}, whereby when in the position shown in Fig. 4 the tension-roll c^7 will clamp the wire against the feed-roll c^6. When it is desired to withdraw the tension-roll c^7—for example, when fresh wire is to be inserted—the lever c^{14} is moved so that its short bearing end will release the pressure upon the piece c^{12}, thus releasing the pressure of the roll c^7 upon the feed-roll c^6 sufficiently to allow the wire Z to reeve freely between the rolls. By this means also the feed is adjusted to different sizes of wire. It will be seen in Fig. 2 that the cam C is so shaped as to give the slide c a long dwell in its forward position and a quick retreat; but as it is manifest that the feed must be adjusted to correspond with the desired length of the nail means for adjustment have been provided, which are referred to below. This method of adjustment I believe to be new.

In feeding the wire from the position shown in Fig. 16 to the position shown in Fig. 17 it is carried down into a pair of dies h^8 h^8, (shown in Figs. 10 to 13,) mounted in the carriage h^6, the space at the upper end of the dies being slightly enlarged, as there shown, to shape the head of the nail. When the wire has been pushed into this die by the feed mechanism, it is seized by a gripping and heading mechanism, which will now be described.

Upon the inner face of the wheel D is a cam-groove, in which works a cam-pin mounted on the end of a lever d, pivoted to the frame at d'. The lower end of this lever is connected by a link d^2 to the connecting-pin d^3 of a small pair of toggle-arms d^4 d^5, the upper end of the toggle-arm d^4 being pivoted in the block d^6, adjustably connected to a piece d^7, which projects laterally from the upper end of the slide e'. The lower end of the toggle d^5 is pivoted to a link d^8, which is pivoted to a rocking jaw d^9, which rocks upon the pin d^{10}, carried by a second jaw member e. These jaws have two movements: First, the movable jaw d^9 is closed against the other jaw e to grip the wire; second, when closed together both jaws have a short downward movement, which upsets into the cavity at the upper ends of the dies h^8 h^8 such metal as lies between said jaws and said dies, thus forming the nail-head z^2, as shown in Fig. 18,

and using up an amount of wire represented by the difference in level between the upper end of the wire in Fig. 18 and the upper end of the wire in Fig. 17. After this the jaws open to allow the slicer f^5 to coöperate with the jaw *e*, as below described, and after the slicer has withdrawn the jaws move upward, so as to be in position to head the next nail. The downward movement referred to is given from the cam E, against the face of which runs a cam-roll on the lower end of a swinging arm e^2, pivoted to the frame at e^3. A link e^4 connects the arm e^2 with the connecting-pivot e^5 of the toggle-arms e^6 e^7. The upper toggle-arm e^6 is pivoted to an adjustable block e^8, connected to the frame. The lower toggle e^7 is connected with the jaw member *e* by means of the slide e', which carries the jaw *e* at its lower end. The cam E acts against the force of a spring e^{10}, the end of which is fast to the box f^4, the free end bearing upon the slide e'. To the upper end of the slide e' is attached the piece d^7, to the lower end of which the toggle system operating the movable jaw d^9 is attached, some such arrangement being necessary in order that both jaws may reciprocate to upset the metal to form the nail-head.

The next operation in the treatment of the wire is the cutting off of a slice above the formed head to narrow the shank, so that the point for the next nail may be made, the wire after the slicing operation being in the condition shown in Fig. 19. This operation is performed from the cam F, in the groove of which runs a cam-roll mounted on the lever *f*, fulcrumed on the frame at f'. The lower end of this lever is connected by a link f^2 to a slide f^3, which lies on the clamp-slide j^2 below the block f^4. The slide f^3 is recessed along one side, (see Fig. 24,) and in that recess lies the knife f^5, which is formed with a groove on one side to receive a rib on the side of the slide f^3, the rear end of the knife lying against a set-screw f^6, which passes through the rear of the slide f^3. The knife f^5 and slide f^3 reciprocate together between adjustable plates f^7 f^8, the plate f^8 being held in place by means of the pin f^9, projecting from the frame, and the piece f^7 being held in place by a recess in the plate f^{10}, attached to the side of the block f^4. It is necessary for the proper operation of this knife that its reciprocation should be in line with the front of the stationary jaw *e*. The wire lies in the groove e^{11} in this jaw during the slicing operation, and it is equally necessary that the knife shall be carefully adjusted to slide in engagement with the entrance to the said groove. This adjustment is caused by placing one or more strips of paper f^{11} or other suitable material behind the plate f^8, then to setting up the screws f^{12} f^{12}, so that the knife f^5 will bear against the plate f^8 and the plate f^7 will have a bearing against the side of the slide f^3, thus forming a close passage in which these parts move. In this way the position of the knife may be adjusted to compensate for wear upon any of these parts. When the heading operation is finished, the movable jaws open, the slide f^3 moves forward, and the knife f^5 cuts the necessary slice off from the wire just above the head to narrow the wire, so as to begin the point for the next nail. It then returns immediately to its rearward position.

The next step is the cutting of the nail from the stock, as indicated in Fig. 20. For this purpose the wheel D has a cam-surface about its periphery which engages a cam-roll G, mounted on a slide *g*, sliding in front of the machine behind the strap g'. This slide *g* is pivoted to the central pivot of the two toggle-arms g^2 g^3. (See Fig. 9.) One of these toggle-arms g^2 is connected to a three-sided frame g^4 and the other to a three-sided frame g^5, each frame sliding in suitable bearings in the head A′, and the two frames forming substantially a rectangle one of the sides of each of which overlaps the other where the frame is connected to the toggle-arms, the opposing sides carrying the cutters g^6 g^7. Springs g^8 g^9 are provided, which bear against portions of the frame and tend to separate these frames, while the spring g^{10} keeps the cam-roll G against the periphery of the wheel D. The cutter g^6 is slotted at g^8, and through the slot passes the driver *h*. The cutting edges of both cutters are beveled, so that in cutting they squeeze and temper the end of the nail and form a V-shaped point thereto, as well as to detach the nail from the wire, and this is an important feature of my invention, for where a nail of this general shape has heretofore been made it has not been provided with a point, hardened and beveled on one or both sides, as may be desired, to govern driving and clenching. The nails made prior to this invention have been apt to drive crooked because of the pressure of the leather against their long beveled sides. As shown in the drawings, the cutter g^6 has a V-shaped edge and the cutter g^7 a chisel edge—*i. e.*, an edge beveled only on its upper side. The movement given to the cutters should be sufficient to allow them to come together when they perform the cutting operation, and their reverse motion should be sufficient only to allow them to open out of the way of the heading mechanism. In coming together those parts of the cutters which are above the cutting edge pinch the point, so as to harden it for the purpose described, and by changing the knives or adjusting them in their holding-frame the shape of the nail-point can be changed and its direction with relation to the axis or central line of the wire and also be controlled, so that the exact direction in which the nail will pass through the leather can be to a very large extent predetermined. So far as I know, this has never before been accomplished and is an important feature of my invention. This completes the operations indicated in Fig. 20. The carriage holding the nail-dies must then be reciprocated to carry the nail from a position under

the wire to the position under the driver, as indicated in Fig. 21. It is given a reciprocating movement from the cam H, in the groove of which lies a cam-roll mounted on the end of a horizontal rocker-arm h'. A vertical rock-shaft h^2 passes down through the head and carries on its lower end an arm h^3, the outer end of which is bent somewhat downward, so that its end h^4 will lie in a box h^5, held to the carriage h^6 by two projecting pieces h^7 h^7. The carriage h^6 slides in suitable bearings in the base of the machine and crosswise of the machine. It contains the dies h^8 h^8, each of which is mounted in a jaw h^9, the jaws being held together by springs h^{10}. The strength of these springs is sufficient to hold the severed nail in place in the die, but not so strong that the fresh wire when fed down will not force its way between them. Below the dies are located a pair of spring-jaws h^{11} to center the lower end of the nail. These jaws are slitted lengthwise or made in two pairs, so as to hold the point of a short nail or a long one, whichever the machine is making. It is, in fact, one of the novel features of this machine, as will be more fully explained below, that in it the nail is held positively from the moment when it is detached from the wire to the moment when it enters the shoe-sole or other part into which it is to be driven. It is thus always under control and has not the opportunity to turn either on its longitudinal axis or otherwise during its course from under the wire to the work.

A clamping mechanism is provided to clamp the dies in the carriage during the heading operation. This clamping mechanism is operated from the cam J by means of the lever j, fulcrumed in the frame at j' and connected at its lower end with the clamp-slide j^2, the end of which, j^3, at the proper time abuts against the inner jaw on the carriage and clamps it while the head-forming mechanism is making the head. This clamp-slide also serves as the bottom of the passage in which the knife f^5 and its slide f^3 reciprocate. The movement given to the clamp-slide j^2 is very small.

To save time in the operation of the machine, the carriage is slotted at h^{12}, so that it may be moving laterally while the driver is ascending.

The driver k is mounted on the end of a driver-rod k', controlled by a spring k^2 in the manner referred to in the Weeks and Tuttle patent and is raised bymeans of the cam K, which engages with a projection k^3 on the driver-rod k', raising it against the force of the spring and letting it fall at the proper time. The driver therefore is raised slowly and falls by the force of the spring k^2. R′ is the nozzle, which holds the nail and through which the lower end of the driver reciprocates and against which the shoe is held.

My machine may be a constantly-running machine, or it may be operated with a clutch to give it a single rotation merely, as preferred. I have shown in the drawings the clutch mechanism which I prefer to use and which will now be described.

B′ is a pulley connected with the source of power. This pulley is free to turn on the cam-shaft B and has a projection b upon its inner face. To engage with this projection and form the temporary connection between the pulley B′ and the cam-shaft B, I have provided a latch b', mounted in a sleeve b^3, fast on the shaft B to slide toward and from the inner face of the pulley B′. A spring b^2, also carried by said sleeve, engages a pin b^4, which passes through the latch b' and tends to throw the latch b' into engagement with the projection b. (See Fig. 8.) When the latch and projection are engaged, the pulley B′ causes the rotation of the cam-shaft B. To withdraw the latch and lock it out of engagement with the projection b, I have provided a segmental wedge-piece b^5, mounted on an arm b^6, carried by a stud b^7 on the head A′. The latch b' is provided with a wedge-like shoulder b^8, located to ride upon the wedge-piece b^5 as the cam-shaft carrying the latch rotates, and thus withdraw the latch from engagement with the projection b against the force of the spring b^2, (see Fig. 7,) and thus disconnect the cam-shaft from the source of power.

To release the latch b', so that the spring b^2 will cause it to engage the projection b on the pulley B′, the wedge-piece b^5 is withdrawn, and for this purpose there is provided a treadle b^{16}, connected by a connecting-rod b^9 with a lever b^{10}, pivoted to the frame. The inner end of this lever is connected by a link b^{11} with a slide b^{12}, sliding in ways b^{17} in the frame, and connected by a link b^{13} with the wedge-piece b^5. A spring b^{14}, lying between the lower edge of this slide and a projection b^{15} from the post, holds the slide and consequently the wedge-piece up to its work. The wedge-piece may be withdrawn therefrom by depressing the treadle b^{16}, and the spring b^{14} will force it back into position to engage and withdraw the latch when one revolution of the cam-shaft has taken place.

The above describes a machine which can be adjusted to perform all the necessary operations of feeding the wire and making, cutting, and driving the nail; but in addition the machine shown in the drawings has means for feeding the shoe and for altering the wire-feed automatically to meet the ordinary variations in the thickness of the stock through which the nail is to be driven, so that the feed will conform to the requirements of the work. This latter mechanism will now be described.

The shoe is supported against the driver nozzle or throat R′ upon a horn m^9, carried by an arm m^8 on a post m^7, sliding in bearings A^4 in the standard A. (See Fig. 22.) On the post m^7 is mounted an adjustable sleeve m^4, to which is pivotally connected a lever m^6. As a convenient means for attaching the lever m^6 to the rod m^7 I have shown a pair of

fingers m^{22}, which fit in a groove in a collar m^{14}, adjustably carried by said rod m^7. The lever m^6 is connected by a stud m^5 with a slide-piece m^2, sliding in bearings A^5 A^6 in the frame. The lower part of this slide-piece m^2 terminates in a rod m^{13}, surrounded by a spring m^{11}, which is compressed between the bearing A^6 and a collar m^{12}, adjustable on the rod m^{13}, this spring holding the slide-piece m^2 and lever m^6 up to their work with a yielding pressure.

m' is a connecting-rod connecting the slide-piece m^2 with a treadle M, pivoted at m, by means of which the horn mechanism may be depressed in order that a shoe may be removed or a shoe to be nailed may be put in place. The lever m^6 rests at its rear end upon a finger m^{10}, bolted to the frame A, and it is held against this finger by means of a spring m^{15}. The horn is then depressed for the purpose of changing the work by depressing the lever M; but it is necessary also that it shall have a slight reciprocating movement during the operation of the machine in order to relieve the shoe of pressure, so that it may be automatically fed by the feeding mechanism after a nail is driven. For this purpose there is provided a rod n^4, which passes through the lever m^6 and is provided on its lower side with a collar n^7 and set-nut n^8. This rod n^4 passes up to and is connected with a cam-lever n^5, having a cam-roll n^9 running in a cam-groove in the wheel N on the cam-shaft, said cam-lever being pivotally mounted on the stud n^6, (see Fig. 2,) the ends of which are supported in suitable bearings in the head A'. This cam is constructed with a slight rise, and the rise is timed to lift the rear end of the lever m^6 against the force of the spring m^{15}, so as to depress the horn slightly just after the nail has been driven, at which instant the feed operates, as will be described below. For this purpose the stud m^5 is made to serve as a fulcrum, about which the lever m^6 turns, the lever m^6 being clamped in the following manner: Ordinarily the stud m^5 has a floating support due to the upward pressure of the spring m^{11}. To clamp it to form a fixed fulcrum, I have provided two trunnions n, which are threaded and worked in nuts n', attached in openings in the standard A, the trunnions carrying arms n^2, which are connected by links n^3 with a sliding collar n^{10} on the rod n^4. Two adjustable collars n^{11} and n^{12} and a spiral spring n^{13} limit the movement of the collar n^{10}, and consequently of the trunnions n. The threads of the trunnions are right and left handed threads, the construction being such that as the rod n^4 and consequently the arms n^2 are lifted by the cam N the trunnions are screwed against the pin m^5 and hold it tightly, so that it forms a proper fulcrum for the lever while the rear end of the lever m^6 is being lifted by the rod n^4 and its collar n^7. This changing of the fulcrum takes place just prior to the engagement of the collar n^7 and the lever m^6. The lever is thus transformed into a lever of the first order. This, however, only takes place at the instant when the horn has withdrawn the shoe preparatory to the feed and during the feeding operation. At other times its fulcrum is on the finger m^{10}, so that pressure on the treadle M may easily depress the horn.

To adjust the exact length of the wire-feed, the following mechanism has been provided: It will be remembered that the length of this feed is dependent upon the length of stroke of the slide-piece c, which is thrown forward by the cam C against the force of the spring C^2. It was stated above that the cam C gives the slide c a long dwell in its forward position, but a quick retreat. Upon the length of this retreat the length of the next forward stroke which performs the feeding operation depends. As a means for automatically determining the length of rearward movement of the feed-slide c, and hence of the amount of rotation given to the disk c^4, shaft c^5, and feed-roll c^6, mounted thereon, upon its next forward stroke, I have provided the feed-slide c with a slanting piece c^{16}, which is located and adapted to engage with a triangular stop p. This stop p slides in a guide-piece p', adjustably fastened to the frame at p^2, the slide connection between the stop p and the guide-piece p' being at an angle with the vertical line, so that as the stop p is moved up or down in the guide-piece p' it will be moved farther away from or nearer to the tailpiece c^{16}, and so govern the distance which the tailpiece, and consequently the slide, will be moved rearward by its spring C^2. To operate the stop p automatically, it is connected to the horn-carrying mechanism in the following manner: The stop p is mounted on the upper end of a rod p^2, which passes downward into the standard A' and is connected to one end of the lever p^4, fulcrumed in the standard. The other end of this lever is connected by a link p^5 with the piece m^4 on the post m^7. Thus it will be seen that every movement of the horn produces a corresponding movement of the stop p, and the length of the rearward stroke of the slide c and of the amount of rotation given to the feed-roll c^6 is consequently governed by the position of the horn.

For feeding the shoe mechanism is shown in detail in Figs. 14, 15, and Fig. 26. This mechanism consists of a swinging arm q, pivotally mounted in a slide Q, sliding in ways Q', mounted on the under side of the plate R^2. The pivot which connects the swinging arm with the slide Q also carries a roughened feed-wheel q' and a ratchet q^3, operated by a pawl q^5, carried by the swinging arm q, so that a rocking motion given to the arm q causes the feed-wheel q' to rotate in a direction to feed the shoe, the return of the arm q having no further effect upon the feed-wheel. As shown, the pawl q^5 slides toward and from the ratchet in ways in the arm q, being held to the ratchet by a suitable spring. This construction will be understood from Fig. 26, in

which it is shown somewhat diagrammatically, but clearly enough, it is believed, to answer the purpose. This mechanism is well known and need not be further explained.

The arm q is grooved at q^2, (see Fig. 4,) and in this groove runs a pin mounted on the end of an angle-arm q^4 on the lower end of the rock-shaft h^2, which moves the nailing-carriage h^6, this rock-shaft and its cam H therefore serving not only to reciprocate the carriage, but also to feed the shoe. It will be noted that the movement of the rock-shaft h^2 in a direction to cause the carriage to carry the nail to the driver produces no effect on the feed-wheel, while the movement of the rock-shaft to return the carriage under the wire causes the shoe-feed to operate. Thus the nail which is being driven and the surface of the shoe into which it is to be driven reach a position under the driver at the same instant. The slide Q has two racks Q^3, each of which engages with a pinion Q^4, mounted on a shaft Q^5, having on its outer end a square head Q^6 or other means for turning it. By this means the position of the slide may be moved so as to govern the position of the feed-wheel q' with relation to the throat-piece R′ and to determine the distance from the edge of the shoe-sole at which the nails are to be driven.

The throat-piece R′, against which the work is pressed by the horn m^9, is set into the under side of the plate R^2, which carries the feed-wheel slide Q^3. This plate R^2 has a groove R^3 running the entire length of its upper side, and the opening in the throat-piece through which the nail and the driver k pass registers with a corresponding opening in the groove R^3. One side of the throat-piece R′ is slotted to receive the latch R, and the plate R^2 is slotted to correspond, so that the upper portion of the latch R, which is enlarged to form a head and provided with a rocking under surface r, will rest and rock upon the bottom of the groove R^3. A bar r^4 lies in one end of the groove R^3, and its inner end where it comes in contact with the head r of the latch R is notched, as is also the head of the latch R, these notches forming together the mouth of the opening into the throat-piece. This bar r^4 is held against the latch by springs r^5, attached to the end of the plate R^2. The head of the latch R is held against the bar r^4 by means of the bar r' in the other end of the groove R^3 and the springs r^2. A heavy spring r^3 is attached to the under side of the plate R^2, its free end bearing on the lower end of the latch R. The force of the springs r^2, r^3, and r^5 pushes the latch R against the opposite side of the passage in the throat-piece, so as to close it except against the downward movement of the nail and driver. Thus as the nail passes into it the latch R will yield slightly, pushing the nail against the opposite side of the passage and so insure the direct movement of the nail through the throat. The rocking surface r of the latch allows it to rock to conform to the changing position of the nail as it moves down the throat, so that it always keeps its grip on the nail.

I have shown the horn m^9 as supported on the end of the arm m^8. I prefer to form the end of the arm m as an open clamp S, the ends of which are clamped about the bottom of the horn by the bolts S′. The upper edge of the clamp is notched at S^2, and pin S^3, passing through the horn, rests in this notch and supports the horn and keeps it from turning. By this means the horn is held securely and at the same time may be released, so as to be swung out of the way in case it is desired to get at the under side of the throat-plate.

It is believed that the operation of the several parts of the machine will be understood from the foregoing description of its construction. The timing of the operation, however, is as follows: The clutch normally releases the cam-shaft immediately after a nail has been driven, so that when the machine is in a state of rest the driver is down, the carriage is in its left-hand position, and the horn still presses the work against the throat-piece. The treadle M may now be depressed in order that a shoe may be placed upon the horn m^9. This having been done, the treadle M is released and the operator puts his foot upon the starting-treadle b^{16}, which withdraws the wedge-piece b^5, so that it releases the latch b' and allows it to be in position to be struck by the projection b on the loose pulley B′ on its next rotation, thus engaging the cam-shaft. The stud m^5 is bound by the trunnions n, which are operated by the cam N and rod n^4. The continued upward movement of the rod n^4 causes the collar n^7 to engage with the lever m^6 and lift it about the stud m^5, thus withdrawing the horn slightly and allowing the work to feed. It then rises and by relocating the wedge-stop p controls the amount of wire to be fed for the next nail. While this operation has been taking place, the carriage from which a nail has just been driven is moved backward under the nail-making mechanism to receive the wire for the next nailing, forcing its way past the driver, which, when it drives the nail, passes between the dies h^8 and now takes position in the opening h^{12} until it is lifted into position from which to drive the new nail. At the same time also the wheel q' is rotated to feed the shoe. While these movements are taking place, the driver lies in the slot h^{12}, which is sufficiently long to allow the carriage to reach the end of its movement without interfering with it. During this time also the horn has made its complete movement, releasing the shoe, and, after the feed, gripping the shoe again. When the horn has returned, the driver begins to ascend, the wire-feed takes place, and immediately thereafter the nail-making operations, which are shown in Figs. 16 to 21, inclusive, take place, and the

nail having been made and cut off the carriage carries it under the throat-plate and at the same time the arm which moves the shoe-feed moves into position to feed the shoe when the horn next releases it. The driver then descends and drives the nail, and the clutch is disconnected, so that the machine stops unless the operator keeps his foot upon the treadle b^{16}, in which case the operation of the machine is continuous until the treadle is released and the wedge-piece b^5 engages with the latch and releases the cam-shaft from the pulley, which always happens at the end of the driving operation.

In the construction of this machine I have preferred to use toggle movements in most instances to accomplish my results; but it is evident that other mechanical movements may be adopted instead to give the necessary operations to the various parts, and, moreover, while it is desirable that the cycle of operations be as suggested they may be varied somewhat and the construction of parts by which the nail-making operations are performed may be varied somewhat without departing from the spirit of my invention. This is especially true of the fulcrum-stud m^5, which may be clamped by cam-surfaces instead of the screws shown or by other means which will suggest themselves to mechanics, the important feature of this part of my invention being that the stud shall be gripped automatically by some instrumentality and released at the proper time. This machine is, in fact, so far as I know, the first machine in which the carriage which conveys the finished nail to the throat through which it is to be driven contains a pair of dies which receive that portion of the wire which is to form the head of the nail and assist in the formation of the nail-head prior to the time when the nail itself is cut from the wire. The spring-jaws h^{11} serve to hold the lower portion of the wire, which has already been shaped to form the point of the nail, and it will be noted that in this machine the nail is held positively from the time it is cut from the wire until it has been driven into the shoe. It is held positively by the carriage during the cutting operation, its head being located in the dies h^8 and its point in the jaws h^{11}, two pairs of which are provided to accommodate nails of different lengths, and from these dies and jaws the nail is driven by the driver through the throat-piece into and through which it forces its way against the force of the springs controlling the latch R. This is a very important feature of my machine, in fact of any machine by which a nail of the general class herein shown is driven, for when one side of a nail-point is beveled the nail is apt to be driven crooked unless a certain predetermined relation is established and maintained between the nail and those parts which handle and drive it.

I have shown in Fig. 22^A a pawl-and-ratchet mechanism by which to operate the wire-feed. The part which I have termed the "disk" is loose upon the shaft c^5 and has, in fact, a recessed enlargement t, in which are set four pawls t', each controlled by a spring t^2 to hold them against the ratchet t^3. The ratchet t^3 is attached to a covering-disk t^4, both of these parts being fast upon the shaft c^5. The link c^3 being connected with a pin on the back of the disk c^4, so as to oscillate it in the direction of the arrow, causes the shaft c^5 to turn, and consequently turns the feed-roll c^6. The reverse oscillation of the disk c^4 has of course no effect upon the shaft or feed-roll. This is merely one of the number of ways in which this result may be accomplished.

Having fully described my invention, I claim and desire to secure by Letters Patent of the United States—

1. In a nail-making machine in combination with nail-driving mechanism and a wire-feed, a reciprocating carriage containing nail-head-shaping dies suitably mounted therein and adapted to hold the wire blank, means for heading said blank and detaching the nail, operative while said blank is held in said carriage, and means whereby said carriage is moved from a position under said heading mechanism to a position under the driving mechanism as set forth.

2. In combination with a wire-feed, yielding arms suitably mounted and carrying nail-head-shaping dies normally in contact and adapted to yield to receive the end of the wire during the nail-making operation and hold the nail when detached from the wire, means for heading the nail and detaching it from the wire and means whereby said yielding arms are clamped to hold the wire during said heading and detaching operation, as and for the purposes set forth.

3. In a nailing-machine in combination with nail-driving mechanism and a wire-feed, a carriage containing yielding arms carrying nail-head-shaping dies normally in contact and adapted to yield to receive the end of the wire during the nail-making operation and hold the nail when detached therefrom, means for heading the nail and detaching it from the wire, means whereby said yielding arms are clamped to hold the wire during said heading and detaching operation and means for reciprocating the carriage to convey the detached nail under the driving mechanism, as set forth.

4. In a nailing-machine a driving mechanism, a wire-feed, a heading mechanism and a detaching mechanism, in combination with a carriage containing yielding arms normally in contact, said arms carrying head-shaping dies and means whereby said arms are clamped during the heading and detaching operation and released thereafter and said nail is conveyed under said driving mechanism, as and for the purposes set forth.

5. In a nailing-machine, a carriage having yielding arms carrying heading-dies adapted to receive and hold the nail-blank during the

heading operation, and a pair of yielding arms located below said heading-dies and adapted to receive and hold the lower end of the nail and guide the point of the nail in its movement out from the carriage, as and for the purposes set forth.

6. In a nail-driving machine in combination with a nail-driving mechanism, a reciprocating carriage containing heading-dies adapted to receive and hold the nail-blank end of the wire, means for pointing and heading the nail said heading means coöperating with said heading-dies and said carriage being adapted to carry the nail into position below the driver and guide it when struck by the driver and during its driving operation, all as set forth.

7. In a wire-nail making and driving machine a reciprocating carriage having nail-forming yielding dies located therein and normally in contact whereby a detached nail may be held therein positively and means whereby said carriage is reciprocated from a nail-making position to a nail-releasing position and means for driving said nail downward from between said dies substantially as and for the purposes set forth.

8. In a nail making and driving machine in combination nail-making mechanism comprising heading, pointing and detaching devices, a nail-driving mechanism and a reciprocating carriage provided with yielding heading-dies forming part of said heading mechanism and adapted to receive and hold the nail-blank end of the wire during the heading operation and to coöperate with the nail-detaching mechanism during its detaching operation and to carry the detached nail under the driving mechanism, as and for the purposes described.

9. In a nail-driving machine in combination with a vertically-reciprocating driver, a horizontally-reciprocating carriage moving in a path across the line of motion of said driver and having yielding jaws normally in contact and adapted to receive and hold the nail to be driven and carry it under the driver and hold it thereunder during the driving operation and to be opened laterally by the driver as the carriage starts on its return movement while the driver is still in its lowered position, and means for clamping said jaws while said carriage is in its nail-receiving position as set forth.

10. In a wire-nail making and driving machine, in combination with a nail-making mechanism, a carriage adapted to receive and hold the nail-blank end of the wire, and provided with heading-dies adapted to coöperate with said nail-making mechanism to shape the head of the nail, and to carry the nail under the driver, a driver and a throat located below said carriage and in line with said driver and having a yielding side normally closing the throat, whereby the nail will be held in a predetermined position from the time it is cut off from the wire till it is driven into the shoe, as set forth.

11. In a nailing-machine a nail-driving mechanism and a horizontally-reciprocating carriage and means whereby it may be reciprocated, said carriage being adapted to carry a nail to be driven and having two or more sets of yielding nail-holding devices located one below the other, the upper set being adapted to coöperate with the nail-heading mechanism to make the head and to receive and hold the head when made, and the lower set to receive and center the lower portion of the nail, in combination with mechanism for making nails of different lengths located to feed the nail-blank to the said carriage and make and detach it while therein whereby nails of varying lengths will be made and will be gripped by said yielding nail-holding devices throughout substantially their entire lengths during the nail-making operation and nail-driving operation, all substantially as set forth.

12. In a nail making and driving machine, in combination with a variable nail-feed having a reciprocating slide connected therewith and adapted to operate said feed, means for determining the length of said feed, said means consisting of a work-support, a stop connected therewith in the manner described whereby each movement of said work-support will produce a corresponding movement of said stop, said stop consisting of a triangular piece mounted in ways carried by the frame of the machine, said ways being at an angle with a vertical line running through the machine and said stop lying in the rearward path of said slide, as and for the purposes set forth.

13. In a nail making and driving machine having a yielding work-support, a wire-feed consisting of a feed-roll and means for clamping the wire against it, means for moving said roll comprising a horizontal slide and a pawl-and-ratchet mechanism connecting said slide with said roll, the rear end of said slide carrying a tailpiece projecting downward below the level of said slide, substantially as described in combination with a vertically-movable adjustable stop connected with said work-support and adapted to be operated thereby and located below said slide to engage said tailpiece, as and for the purposes described.

14. In a nailing-machine, a feed-roll support consisting of a plate carrying said feed-roll at its lower end and pivotally mounted on the frame of the machine, its upper end being forked, one fork thereof bearing against a suitable stop on the machine, the other fork carrying a separating-lever of substantially the kind described, all as set forth.

15. In a machine of the kind described a wire-feed, a reciprocating carriage adapted to receive the end of the wire from which the nail is to be made and provided with yielding dies normally closed to form the head for the nail, gripping and head-forming jaws adapted to grip and force a portion of the wire downward into said dies to form said

head and a nail-detaching mechanism in combination with nail-driving mechanism and means for reciprocating said carriage from a position under said detaching mechanism to a position under said driving mechanism, as set forth.

16. In a machine of the kind described a wire-feed, a reciprocating carriage adapted to receive the end of the wire from which the nail is to be made and provided with yielding dies normally closed to shape the head for the nail and means whereby said jaws are clamped during the nail-making operation, gripping and head-forming jaws adapted to grip and force a portion of the wire downward into said dies to form said head, and a nail-detaching mechanism in combination with a driving mechanism and means for reciprocating said carriage from a point under said wire-feed to a point under said driving mechanism, all as set forth.

17. In a machine of the kind described a wire-feed, a reciprocating carriage provided with blank-receiving dies having means for shaping the nail-head, gripping-jaws of the kind described and means whereby said jaws are reciprocated in the direction of the length of the wire to upset the wire into said dies, a slicing-knife adapted to slice a portion of the wire above said nail-head and a detaching mechanism in combination with a driving mechanism and means for reciprocating said carriage from a point under said gripping-jaws to a point under said driving mechanism whereby the formed nail is conveyed into position to be driven, as and for the purposes set forth.

18. In a machine of the kind described, in combination with a carriage having dies to receive the nail and shape its head, a clamp to hold said dies together, reciprocating jaws adapted to upset wire into said carriage-dies, a slicing-knife moving at right angles to said wire and adapted to slice off a portion of a side thereof above said head, and a cutter mechanism adapted to cut said nail from said wire immediately above the head and on a line with the upper surface of the carriage, as and for the purposes set forth.

19. In a machine of the kind described in combination with a detaching mechanism and means for holding the wire comprising a reciprocating carriage provided with normally closed heading-dies, a slicing-knife located above said carriage and adapted to slice off a portion of the side thereof just above said carriage and means for reciprocating said carriage with the detached nail from under said slicing-knife, as and for the purposes set forth.

20. In a machine of the kind described in combination with a detaching mechanism, a reciprocating carriage having normally closed heading-dies and a jaw located immediately above said carriage and having a recess therein to receive and hold the wire against lateral movement, a reciprocating slicing-knife adapted to move along the face of said jaw and the upper surface of said carriage and slice off a portion of the side of said wire immediately above said carriage, as and for the purposes described.

21. In a machine of the kind described in combination with a jaw having a recess therein to receive and hold a wire against lateral movement, a reciprocating slicing-knife adapted to move along the face of said jaw to slice off a portion of the side of said wire, and two ways, one located on each side of said knife, one of said ways being in line with the face of said jaw and the other opposite it, said first-named way being detachable and capable of receiving one or more thicknesses of paper or the like behind it, and said second-named way being provided with suitable set-screws or the like whereby its position may be adjusted toward and from said first-named way, as and for the purposes described.

22. In a machine for making nails, means for making a point thereof, said means consisting of a slicing-knife adapted to remove a portion of the side of the wire and a pair of cutter-knives adapted to pinch the point thereof and detach the nail therefrom, in combination with a reciprocating carriage provided with holding-jaws to hold the nail during said slicing and detaching operation, as and for the purposes described.

23. In a machine for making nails, in combination with a wire-feed, a nail-detaching mechanism consisting of two blades, each mounted in a suitable frame and mechanism whereby each is reciprocated toward and from the other, one of said blades having a V-shaped cutting edge, the other having a chisel edge, said blades being located in line and each being adjustable in its own frame whereby the point of contact between said blades may be adjusted with relation to the central line of the nail to be detached, and said blades will be adapted to squeeze and temper and direct the point of the nail during the detaching operation and to detach the nail previously made substantially on the plane on which the lower surface of said knives travel, as and for the purposes described.

24. In a nail-making machine, in combination with means for making the head and point of the nail, a cutter mechanism consisting of two three-sided frames arranged to form a quadrilateral, one side of one frame overlapping the corresponding side of the other frame, each frame carrying a cutter, said cutters being located in line with each other, and means whereby said frames are moved toward and from each other, as and for the purposes set forth.

25. In a nail making and driving machine, in combination with nail-heading mechanism, a carriage adapted to receive and hold the nail during its heading and cutting operation, and to carry said nail under the driver, a pair of reciprocating cutters located im-

mediately above said carriage, and means whereby said carriage and said cutters are operated, as and for the purposes set forth.

26. In a nail making and driving machine, in combination with a carriage adapted to receive and hold the nail during its heading and cutting operation, and to carry said nail under the driver, a pair of reciprocating cutters located immediately above said carriage and crossing the line of said driver, one of said cutters being slotted, whereby the driver may pass therethrough, and means whereby said carriage and said cutters are operated, as and for the purposes set forth.

27. In a nail-driving machine, a throat adapted to receive and hold a nail in position to be driven, one side of said throat being slotted and having a latch having an enlarged head provided with rocking surfaces on its under side, said latch being laterally supported by said rocking surfaces and adapted to close the slot in said throat, in combination with yielding means whereby said latch is held in said closed position, as and for the purposes set forth.

28. In a nailing-machine, a throat having a slot in one side thereof, a latch having a rocking surface near its upper portion, in combination with a spring, the free end of which is located to bear against the lower portion of said latch, as and for the purposes set forth.

29. In a nail-driving machine, the throat-plate R^2 carrying a throat, said throat-plate being grooved on its upper face and provided with two bars each located in one of said grooves, two springs each located at the outer end of one of said grooves and adapted to hold one of said bars in place, said throat being slotted upon one side, in combination with a spring-latch lying in said slot, said latch having an enlarged head, the under surface of which is curved and rests upon the bottom of one of said grooves and the rear of the head of said latch resting against one of said bars, its front end being grooved and coöperating with the grooved end of the other bar to form a mouth for said throat, as set forth.

30. In a nail-driving machine, in combination with the throat-plate, and means for feeding a nail thereto, a work-feed consisting of a roughened wheel adapted to be oscillated, and means operated by said nail-feed whereby it is oscillated, said wheel being mounted in a slide-piece movable toward and from said throat, and means whereby said slide-piece is adjusted to adjust the position of said roughened wheel in relation to said throat, said means consisting of one or more racks located on the under side of said slide-piece and a pinion suitably journaled and carried on a shaft whereby it may be turned and the position of said slide-piece adjusted, as and for the purposes set forth.

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