

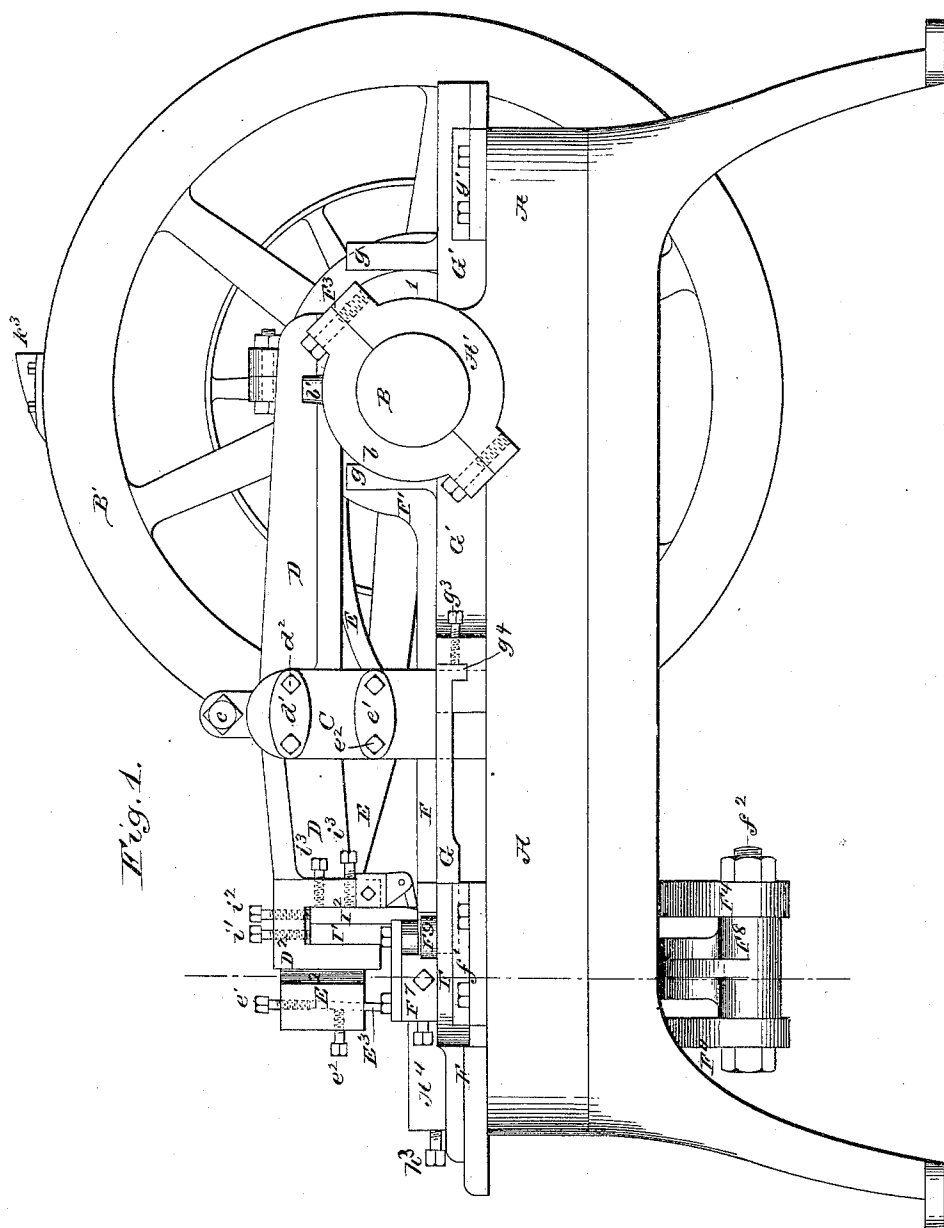
(No Model.)

9 Sheets—Sheet 1.

W. KOPLIN.
SPIKE MACHINE.

No. 319,587.

Patented June 9, 1885.



WITNESSES:

Jno. W. Stockett.
C. C. Poole

INVENTOR

INVENTOR
William Hopkins
BY M. E. Day, Town
ATTORNEY

ATTORNEY

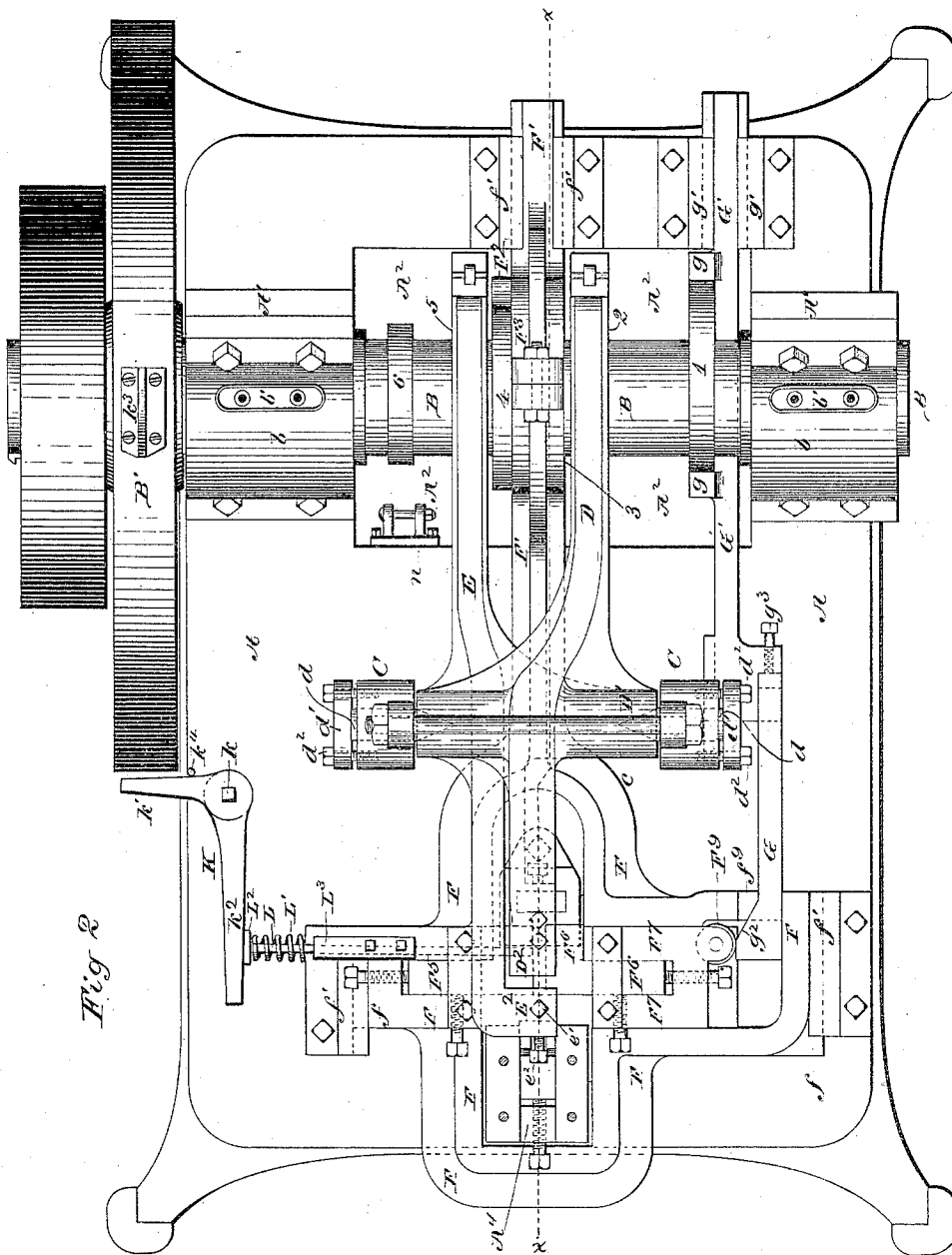
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WITNESSES:

Jno. W. Stockett.
C. C. Poole

INVENTOR

BY *Wm. E. Dayton*

ATTORNEY

(No Model.)

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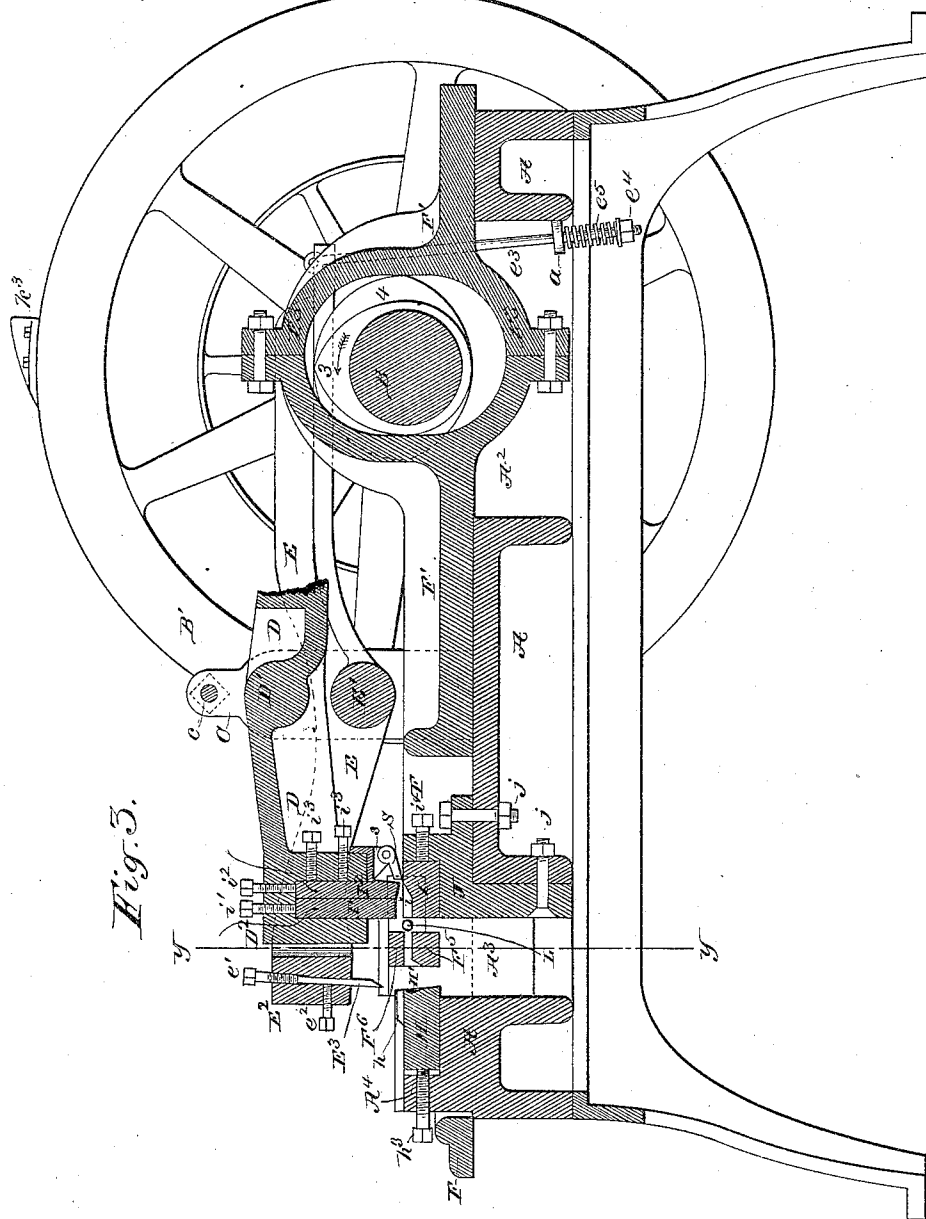


Fig. 5.

WITNESSES:

Jno. W. Stockett

C. C. Poole

INVENTOR

William Koplin

BY *W. E. Dayton*

ATTORNEY

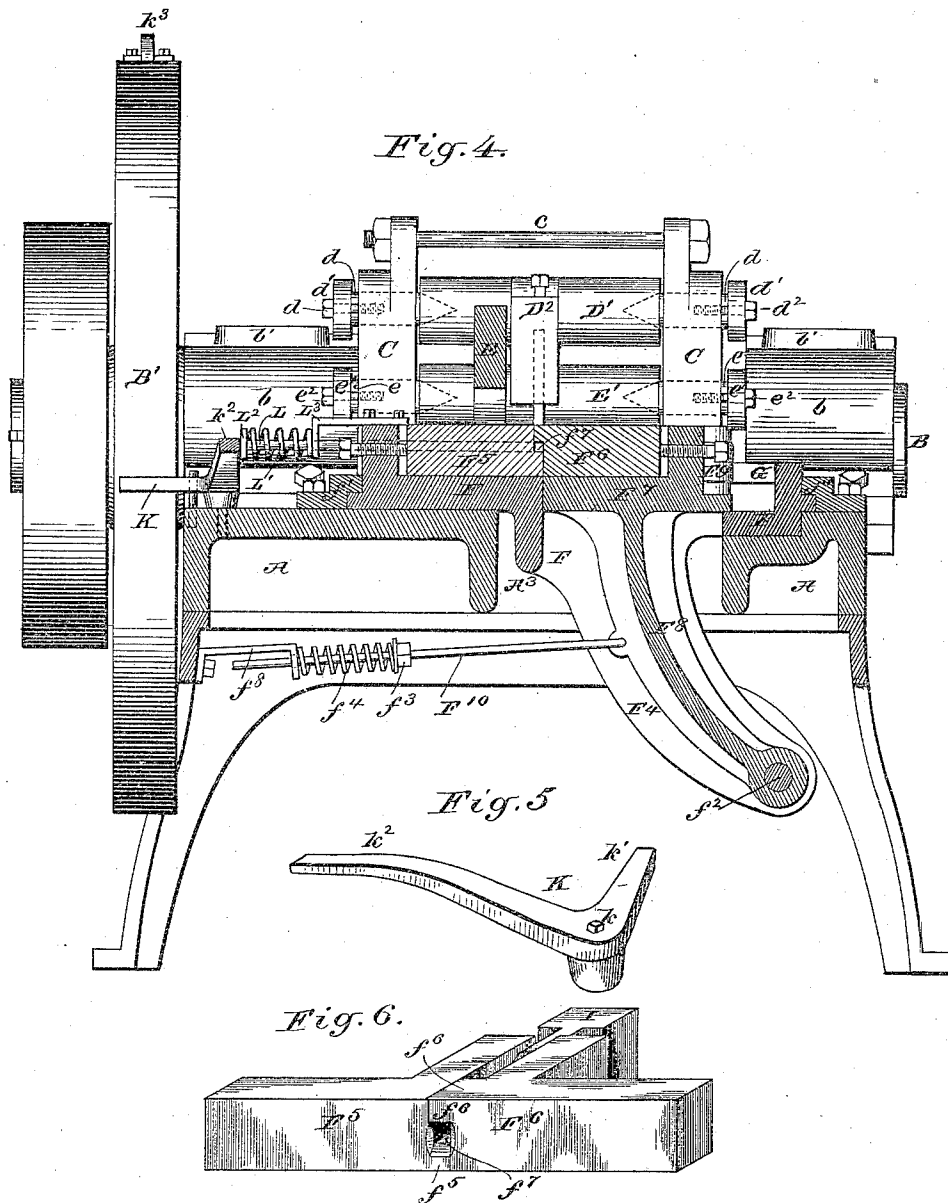
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W. KOPLIN.
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No. 319,587.

Patented June 9, 1885.



WITNESSES:

Jas. W. Stockett
C. C. Poole

INVENTOR

William Koplin

BY *W. E. Dayton*

ATTORNEY

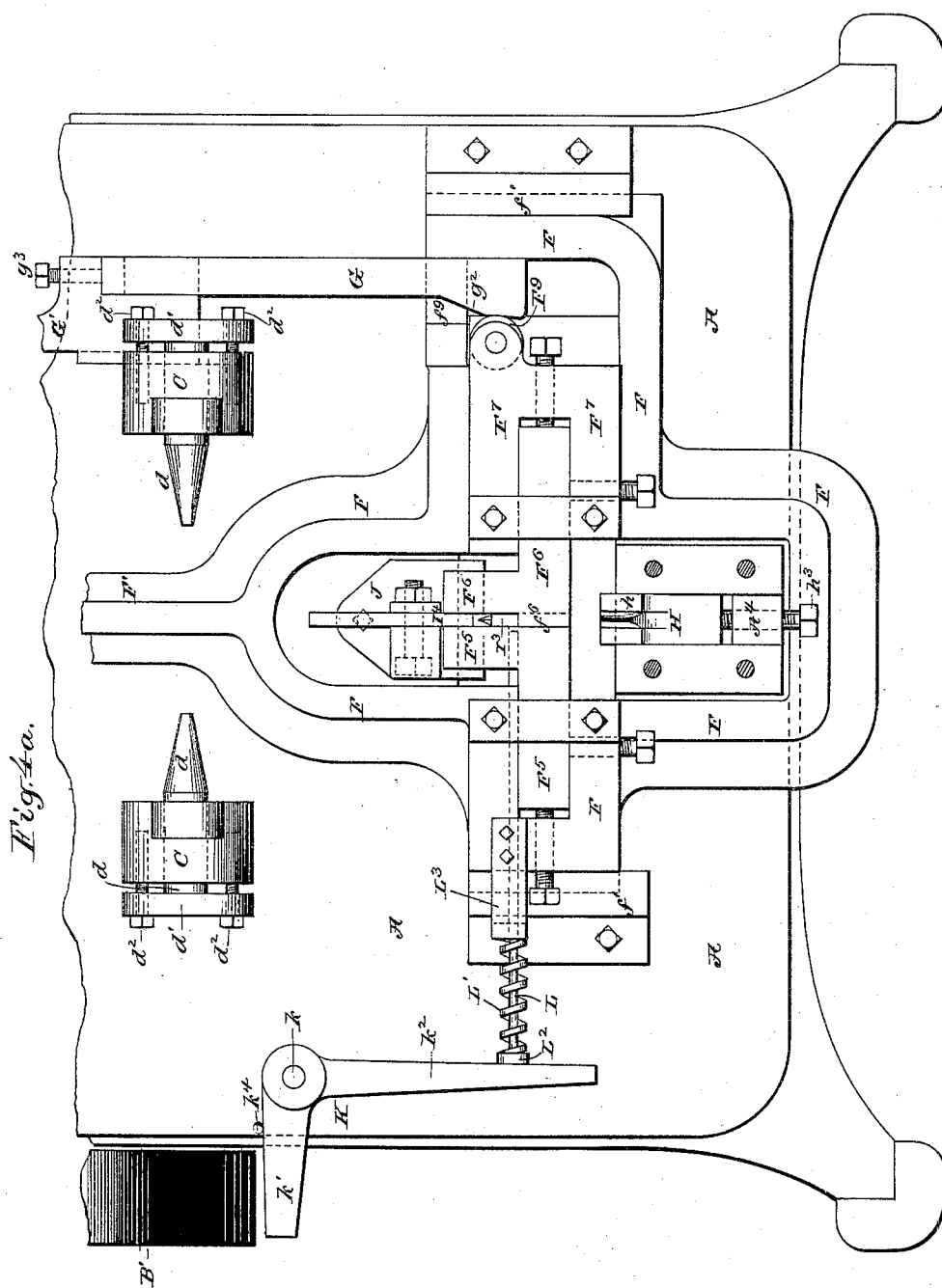
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9 Sheets—Sheet 5.

W. KOPLIN.
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No. 319,587.

Patented June 9, 1885.



WITNESSES:

Jur. H. Stockutt,

C. C. Poole

INVENTOR:

William Koplin

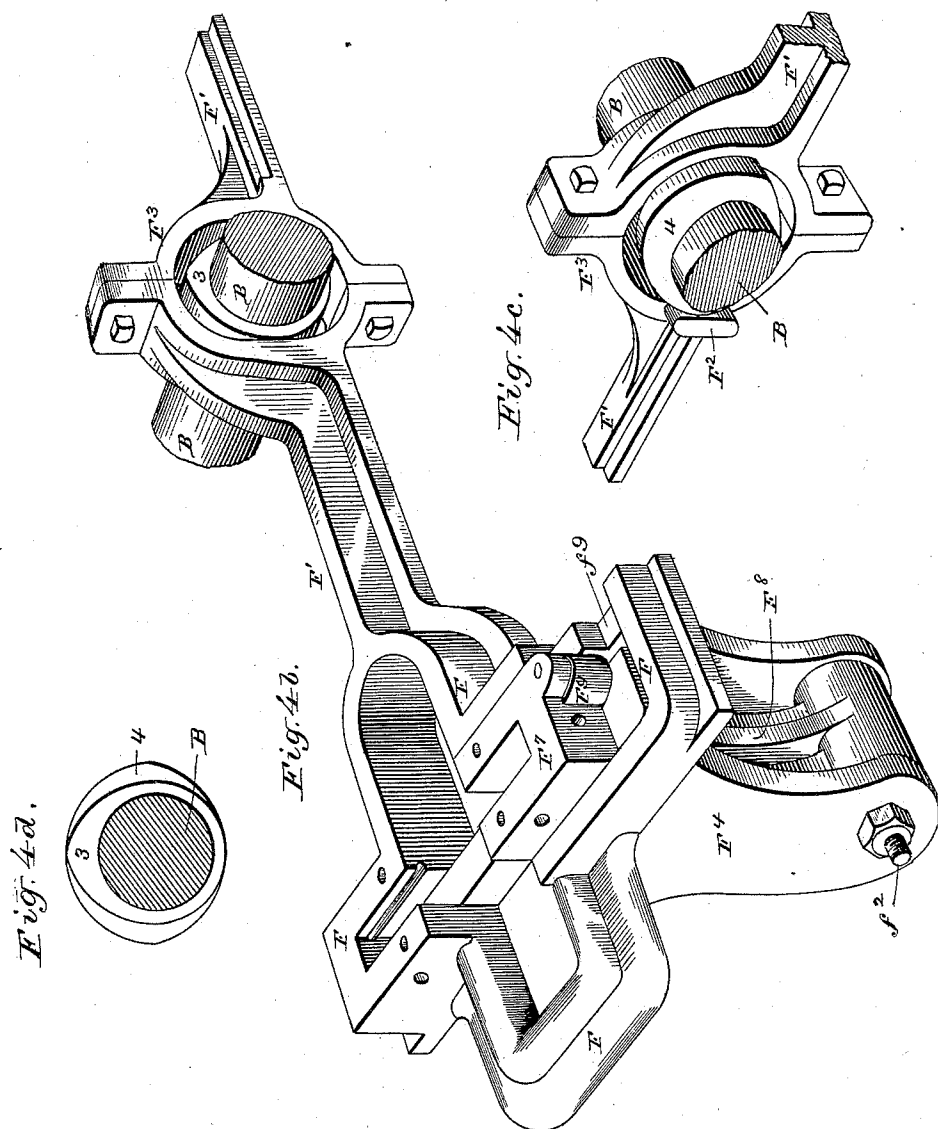
by M. E. Dwyer

Attorney.

9 Sheets—Sheet 6.

No. 319,587.

Patented June 9, 1885.



Jno. H. Stockelt
C. C. Poole

INVENTOR
William Koplin
by W. E. Dwyer
Attorney.

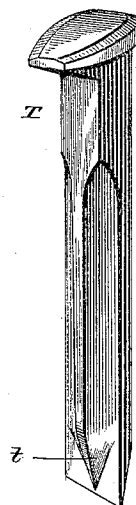
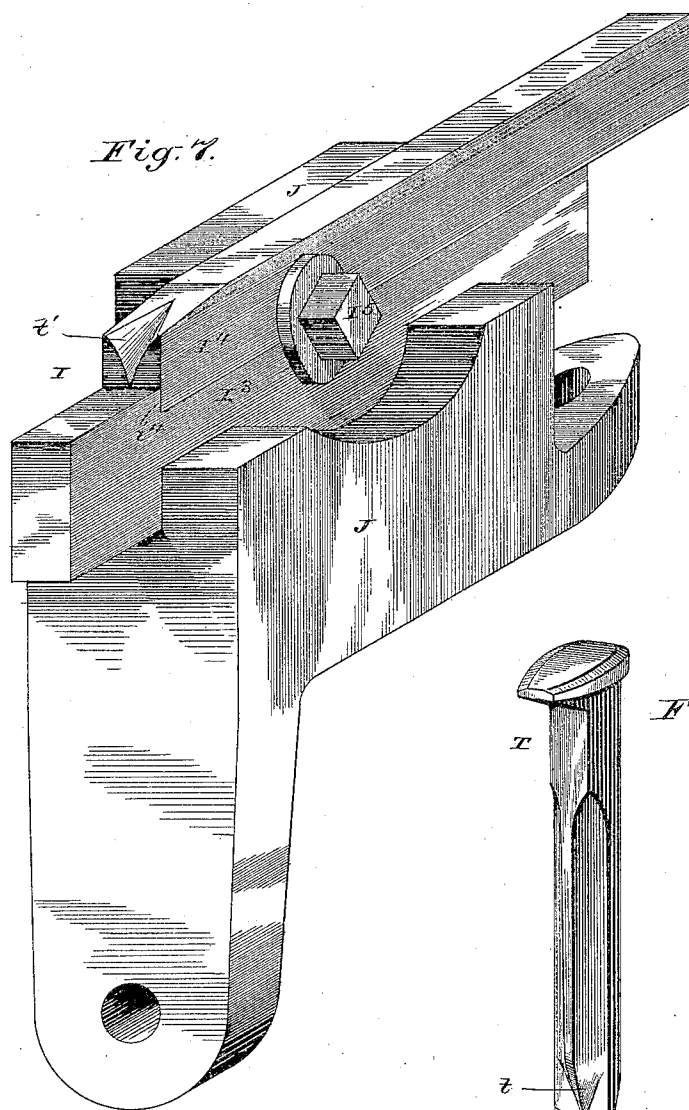
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9 Sheets—Sheet 7.

W. KOPLIN.
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No. 319,587.

Patented June 9, 1885.



WITNESSES:

Jos. W. Stockett

C. C. Poole

INVENTOR

William Koplin

BY *W. E. Dayton*

ATTORNEY

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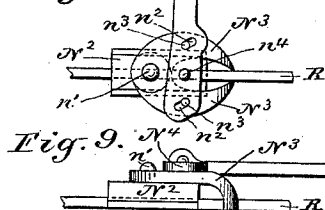
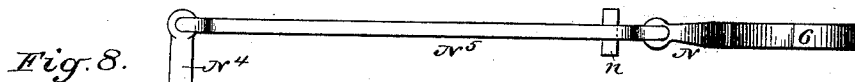


Fig. 10.

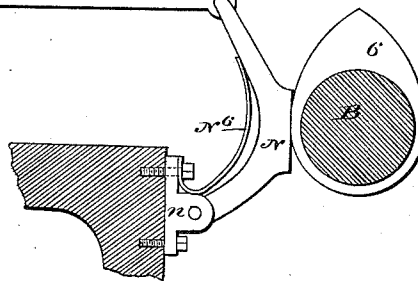
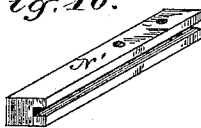


Fig. 11.

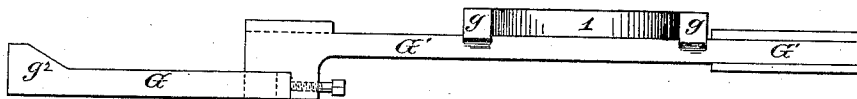


Fig. 12.

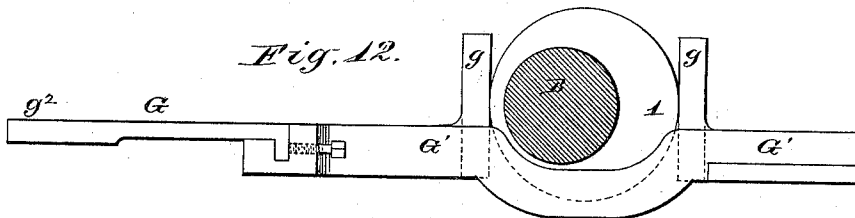


Fig. 13.

Fig. 14.

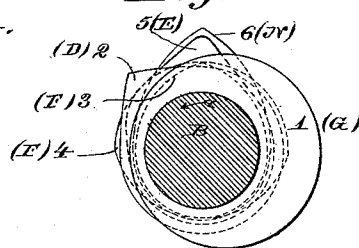
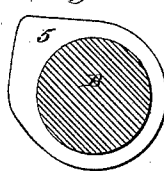
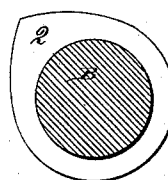


Fig. 15.



WITNESSES:

Jno. W. Stockett,
C. C. Poole

INVENTOR

William Koplin

BY W. E. Dayton

ATTORNEY

(No Model.)

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Fig. 16.

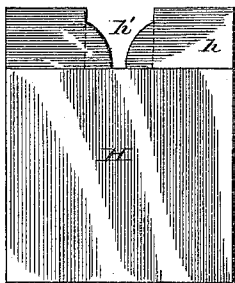


Fig. 17.

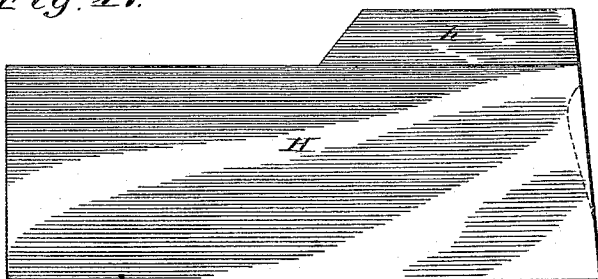
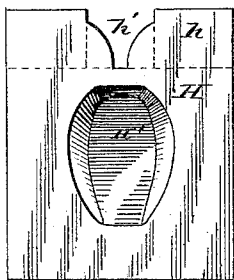


Fig. 18.



Witnesses:
Jno. W. Stockitt
C. C. Poole

Inventor.
William Koplin.
By W. E. Dayton
Attorney.

UNITED STATES PATENT OFFICE.

WILLIAM KOPLIN, OF YOUNGSTOWN, OHIO, ASSIGNOR TO THE PULLMAN
IRON AND STEEL COMPANY, OF PULLMAN, ILLINOIS.

SPIKE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 319,587, dated June 9, 1885.

Application filed July 16, 1883. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM KOPLIN, of Youngstown, in the county of Mahoning and State of Ohio, have invented certain new and useful Improvements in Spike-Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to automatic machines for forming spikes from hot blanks, and concerns nearly all the mechanisms necessary or usually found in such machines for performing the several operations of feeding in the blank-rod, cutting off the blank, straightening the shank, pointing and heading the spike, and discharging the spike from the dies and machine.

The novel features of construction upon which I make claim for invention will be fully explained in the course of the following description, and will be more particularly designated in the appended claims.

In the accompanying drawings, Figure 1 is a side elevation of a spike-making machine containing my improvements. Fig. 2 is a plan view of the same. Fig. 3 is a vertical section in the plane of the indirect line xx of Fig. 2. Fig. 4 is a vertical section in the plane of yy , Fig. 3. Fig. 4^a is a plan view of the front end of the machine with the pointing-die lever and the cutter-lever removed. Fig. 4^b is a perspective view of the traveler detached, together with a part of the cam-shaft by which it is actuated. Fig. 4^c is a fragmentary perspective view showing a part of the traveler and of the cam-shaft, particularly showing the arrangement of the cam by which the traveler is retreated. Fig. 4^d is a transverse section of the cam-shaft detached, showing the two cams by which the traveler is actuated. Figs. 5 and 6 are details. Fig. 7 is a modification of the stationary pointing-die and its holder. Fig. 7^a is a perspective view of a spike having a particular form of point which the machine as shown is adapted to make. Fig. 8 is a plan view of a detached portion of automatic feeding mechanism which may be employed with my machine. Fig. 9 is a side

elevation of the matters shown in Fig. 8. Fig. 10 is a perspective view of a detached guide for the feeding mechanism. Figs. 11 and 12 are respectively a plan view and a side elevation of certain details. Fig. 13 is a section of the cam-shaft, showing the relative positions of the several cams thereon. Figs. 14 and 15 are side views or elevations of particular cams on said shaft. Fig. 16 is a detached end view of the heading-die, its outer end being presented to the eye. Fig. 17 is a detached side view of said heading-die. Fig. 18 is an inner end view of said heading-die, showing the recess therein for shaping the upper or outer surface of the spike-head.

A is a suitably strong machine-bed appropriately mounted upon legs and having cast hereon journal-bearings A' , in which is mounted the driving or cam shaft B, the latter being held in place by the caps b , secured in a familiar manner and provided with oil-cups b' .

In the bed A are provided two openings, A^2 and A^3 , the former for the better accommodation of the cams on the shaft B, and the latter to afford space for the finished spike to drop from the dies and to give room for depending parts attached to the traveler, to which further reference will be made.

C C are uprights located nearly centrally of the machine, intended to afford support for the fulcrums of the pointing-die lever D and the cutter-lever E, arranged one above the other between said uprights. Said levers D and E are constructed, as here shown, each of a continuous casting having lateral projections or hubs $D' E'$, of length nearly equal to, but preferably a little less than, the distance between the inner and parallel faces of the uprights C. The ends of the said hubs $D' E'$ are countersunk to receive the tapered points of the center pins, $d e$, which pass inwardly through the uprights C and enter the recesses in the ends of the hubs $D' E'$. Said center pins are illustrated as being constructed with laterally-projecting heads $d' e'$, exterior to the uprights C, through which pass the adjusting-screws $d'' e''$, entering the uprights, all as plainly indicated in Figs. 1, 2, and 4. The construction described allows slight but all necessary lateral adjustment of the levers to bring them into proper alignment with co-operating

parts, and also for tightening the center pins to compensate the wear thereon. The lever D extends forward from the middle point of the hub D', and centrally of the machine, and terminates in a head, D², recessed to receive the movable pointing-dies I' I², to which further reference will be made. At the rear of the head D² said lever is cut away on its under side to afford room for inserting the forwardly-directed clamping-screws i³, for holding said dies, as indicated in Fig. 3 and by dotted lines in Fig. 2. Said lever D extends rearwardly over the cam-shaft B at one side of the median line of the machine, or in the direction or position indicated more plainly in Fig. 2. The lever E passes forward from the hub E' at one side of the lever D, and at its front end is provided with a laterally-projecting head, E², which stands in front of the head D², and is constructed to admit the knife or cutter E³, together with the adjusting-screw e' and clamping-screw e², as better illustrated in Fig. 3, said knife being arranged in the same central line with the movable dies I' I², located in the head D². The rear end of the lever E extends backward over the cam-shaft and is deflected in a direction opposite to the deflection of the lever D, as shown in Fig. 2. At the rear extremity of each of the levers D and E is pivotally connected therewith a rod, as e³, Fig. 3, which passes through an apertured lug, a, fixed to the machine-bed A. Beneath this lug a spring, as e⁴, surrounds the rod, said spring being confined by a nut, as e⁴, applied to the threaded extremity of the rod e³. By means of these rods and springs the rear ends of the levers D and E are held down upon cams affixed to the shaft D for the vibration of said levers, so that the heads D² and E² of said levers are raised when the cams are in position to permit this movement.

I is a stationary pointing-die secured beneath the movable pointing-dies I' and I² in a suitable recess in the angle-shaped casting J, which casting is fastened to the machine-bed A at the rear margin of the opening A³ by means of suitable bolts, j, as shown in Fig. 3.

H is a stationary heading-die arranged horizontally opposite the stationary pointing-die I, and secured in an appropriate recess in the elevated part A⁴ of the machine-bed A over the front margin of the opening A³. The die H also serves as a stationary knife or cutter, acting in opposition to the vertically-reciprocating cutter E³, the edge of which passes in its downward motion close to the inner vertical face of said die H.

F is a traveler arranged to slide upon the machine-bed A, and consists of a frame having a central oblong opening, by which it surrounds the dies H and I and their immediate supports, as shown in Figs. 1, 2, 3, 4, and 4^b. Said traveler F is provided with lateral projections f, fitted to slide beneath the guides f', which are rigidly attached to the bed A, and by which the traveler is held laterally in place.

At its rear end said traveler F is also provided with an arm, F', constructed to form the yoke F³, embracing the shaft B and a cam thereon for carrying forward the traveler. As seen in Figs. 2 and 4^a, said yoke is provided with a lateral projection, F², on its rear vertical portion, which engages another cam on the shaft B, by which the traveler is retreated. Back of the cam-shaft B the yoke-arm F' is fitted to slide between guides f', which serve to hold the arm in place with reference to the cams.

Referring next to Figs. 4 and 6, F⁵ is a die secured in a recess of the traveler F by suitable clamping and adjusting screws, and constructed with a projection, f⁵, which is intended to support the blank on its lower surface for, say, an inch or more near the proposed head, or at T, Fig. 7^a, while the adjacent vertical and rearwardly-extended face of said die supports the blank on one lateral surface throughout the whole or a quarter of its length.

F⁶ is an opposing die similarly secured in a laterally and upwardly movable frame or die-support, F⁷, which also moves with the traveler F; and said die F⁶ is provided with a projection, f⁶, which bears upon the upper surface of the blank opposite the projection f⁵, while the adjacent vertical and rearwardly-extended face of the die bears against the side of the blank in opposition to the die F⁵. These dies are preferably constructed in L form, as better shown in Fig. 6, so as to bear upon the sides of that part of the blank which is to form the spike-shank throughout its entire length, and to thus insure its straightness.

The projections f⁵ and f⁶, with the adjacent bearing-faces of the dies, form an orifice, f⁷, by which, when the dies are brought together, the blank is entirely embraced in that portion thereof which is to form the shank of the spike near the head. The front faces of said dies are recessed or cut away about the orifice f⁷, as plainly indicated in Fig. 6, in order to give proper shape to the under surface of the spike-head. The dies F⁵ and F⁶ having a movement with and by means of the traveler F, the projections f⁵ and f⁶ are narrower than the space between the dies I and H, and in practice are made to nearly or quite touch the die I when the traveler is retreated and to approximate the die H when the traveler is advanced.

In addition to its bodily movement, derived from the traveler, as described, the die F⁶ has a reciprocating movement in a lateral and upwardly-inclined direction, or in the direction, substantially, of the diagonal of the orifice f⁷. For this purpose the following devices are here provided: F⁴ F⁴, Figs. 1 and 4, are two depending and laterally-projecting arms belonging to the traveler F, between which is an open passage or space longer from front to rear than the length of a finished spike, in order to let the spike fall when completed and released from the dies. Within this space is arranged the die-support F⁷, for the immediate support of the movable die F⁶, and said die-support is

provided with a downwardly-directed arm, F^8 , projecting in the direction of and between the arms F^4 , and pivoted to them at their lower ends by the pivot-bolt f^2 . The die-support F^7 is wholly to the left of a vertical plane drawn through the axis f^2 , so that when said die-support F^7 and the die F^6 carried thereby are pushed away from the adjacent die F^6 they are also raised in a direction practically that of a diagonal line drawn through the orifice f^7 .

As an appropriate means for pushing the arm F^8 outward, and thereby elevating the die F^6 in the oblique direction above indicated, a stout rod, F^{10} , is pivoted to the arm F^8 below the bed of the machine, having its free end supported by being passed loosely through an aperture in a stationary bracket, f^8 . A nut, f^2 , or equivalent device, is applied to the rod F^{10} between the bracket and the arm F^8 , and between said nut and said bracket f^8 is arranged an expanding coiled spring, f^4 , which operates through the rod to throw the arm F^8 to the right and thereby lift and retreat the die F^6 . Said die is thrown in the opposite direction, or downwardly and inwardly toward the stationary opposing die F^5 , by means best shown in Figs. 1, 2, 4, and 4^a, consisting of a reciprocating bar, G , provided with the wedge-shaped head g^2 , said bar being supported on its outer or straight side by a portion of the traveler F , and bearing on its inner or inclined side against a roller or projection, F^9 , on the adjacent side of the die-support F^7 . Said bar G is connected with a slide, G' , which extends beneath the shaft B , and is fitted in guideways g' . From said slide G' , on either side of the rotating shaft B , rise the vertical arms g , which embrace a properly-shaped cam upon said shaft. By the action of this cam upon the arms g the slide G' and wedge-bar G are carried backward toward the rear end of the machine, and at the same time, as will further appear, the traveler F advances toward the front of the machine. In this relative movement of the parts named the wedge-face g^2 bears inwardly against the die-support F^7 and forces it and the die F^6 inwardly and downwardly. When said wedge and traveler move in the opposite direction, the spring f^4 , through the rod F^{10} , throws said frame F^7 , with its die F^6 , outwardly and upwardly. In the reciprocating movement of the traveler F the rod F^{10} vibrates to the same extent from the fixed point of its passage through the bracket f^8 , and to permit this vibration of the rod, and the simultaneous longitudinal movement thereof, due to the spring f^4 and wedge g^2 , it is sufficient to make a hole in said bracket for the reception of said rod somewhat larger than the rod itself. The slide G' rests upon the upper plane surface of the bed A ; but the bar G is elevated above said bed, and is supported at its front end by the depressed part f^9 , Figs. 2, 4^a, of the reciprocating traveler F . As the said bar G is subject to wear at its wedge-shaped end, it is desirable to make the same renewable,

and it is therefore shown as being constructed in a piece separate from the slide G' , which may be a casting, and when so made its rear end may be provided with a downwardly-directed projection, g^4 , Fig. 1, fitted into a suitable recess in the adjacent end of the slide G' and held therein by a set-screw, g^3 .

K represents a bell-crank lever. (Seen detached in Fig. 5, and applied to the machine in Figs. 2 and 4.) Said lever is pivoted to the bed of the machine at k by a vertical axis, and, as here shown, has its short arm k' extended in front of and adjacent to the fly-wheel B' on the shaft B in position to be engaged by the cam k^2 , attached to the periphery of said fly-wheel. The long arm k^2 of the lever K extends forward to a point opposite the dies of the machine, where it bears against the end of a rod, L , called a "clearing-rod," which passes through the traveler F and through the rearward extension of the adjacent stationary die F^5 , in position, as shown in Fig. 3, to strike the spike and to throw the same laterally off the supporting-dies when the die F^6 is raised, in order that it may drop between the dies F^6 and F^5 and out of the machine. The rod L , of course, shares the movement of the traveler F , in which it is mounted, and is therefore not attached to the bell-crank, which is stationary. Between its head L^2 and the traveler, or, if present, the supporting-bracket L^3 , is interposed a spring, L^1 , which withdraws the rod the moment the lever K escapes the cam k^2 .

As above stated, the several parts G , D , F , and E are actuated by cams on the shaft B . Said cams are numbered 1, 2, 3, 4, and 5, in their order from the right to the left, as viewed by one standing in front of the machine or adjacent to the traveler F , cam No. 1 being for the actuation of the lever G , No. 2 for the pointing-die lever D , No. 3 for the forward movement of the traveler F , No. 4 for the rearward movement of said traveler, and No. 5 for the cutting-lever E . Another cam, No. 6, is also shown in Fig. 2 of the drawings, being intended for the actuation of an automatic feeding device, separately shown in Figs. 8 and 9, and hereinafter described.

If desired, the clearing-rod L for throwing the spike from the dies may be actuated by a cam on the shaft B , instead of by one located upon the periphery of the fly-wheel, as shown, although, in view of the rapidity of the motion desired on the part of said clearing device, the construction shown is preferable.

The manner in which the several cams are arranged or timed on the shaft B is proximately shown in Fig. 13, wherein the numerals designating the cams are accompanied by the letters applied elsewhere in the drawings to the parts respectively actuated thereby.

The order of the movements of the several working parts of the machine will be further referred to. The cams may obviously be varied in their relative positions to give the required movements of the said working parts.

The cam No. 1, for actuating the wedge, is preferably circular or merely an eccentric wheel fitting between the arms *gg* on the slide *G'*. The cam No. 2, for actuating the pointing-die lever *D*, is of the general shape indicated in the detached view, Fig. 15. The cam No. 3, for carrying forward the traveler *F*, (shown only in dotted lines in Fig. 13, but fully in Fig. 4^d.) has a narrow projection calculated to advance the carrier quickly and to hold it only briefly in its advanced position. Cam No. 4, for retreating the traveler, has its projecting part concentric for, say, half the circumference, and is calculated to hold the traveler in its retreated position for a considerable time to allow the blank to be fed into the machine. Cam No. 3 is located within the yoke *F*³, and No. 4 is located exterior to said yoke and in engagement with the projection *F*² thereon. Cam No. 5, which actuates the cutter-lever *E*, is of the general construction indicated in Fig. 14, being intended to first throw down the cutter far enough to sever the blank from the blank-rod, during which time the dies *F*⁵ and *F*⁶ firmly grip the blank, and after which the cutter further descends and operates to bend the end of the blank downward in front of the dies *F*⁵ and *F*⁶, in order to dispose the metal in proper position to form the head of the spike. The cam No. 5 is constructed to then allow the cutter-lever *E* to quickly retreat to lift the cutter *E*² out of the way and permit the forward motion of the traveler *F*, by which the blank, while grasped between the dies *F*⁵ and *F*⁶, is forced against the stationary die *H* to form the head of the spike. The cam No. 6 is similar in form to the cam No. 2, being intended to give a quick reciprocating motion to the lever *N* and the connected feed mechanism, as will be further explained. The cams Nos. 1 to 5, inclusive, operate to hold the various parts of the machine concerned in forming the spike simultaneously open and retreated, so that the blank-rod may be fed into place preparatory to being cut and shaped. The feeding of the blank-rod may be performed by hand or by means of automatic mechanism, one form of which will be hereinafter further described.

To facilitate the feed of the blank-rod into the machine, the stationary heading-die *H* is constructed with an elevation upon its upper surface and extending to its working face, in which elevation is formed a recess, *h'*, of such shape and size as to permit the rod to be guided properly thereby. In the present case said recess *h'*, as shown in Figs. 16 and 18, is substantially triangular in shape, having curved sides, being intended for a particular form of rod for making the spike shown in Fig. 7^a; but the invention is not limited to the construction of a spike of any particular sectional shape, and the form of said recess *h'*, as shown in said figures of the drawings, is therefore not essential to my invention. The die thus recessed being the stationary cutter, it is desirable that the re-

cess conform to the shape of the blank-rod, in order to support the latter properly when being cut. When the blank is fed inwardly by hand or by a spring-actuated feeding device—such as is herein shown and hereinafter described—a suitable stop is necessary to insure blanks of uniform length. Such a stop is shown at *S*, Fig. 3. The novel feature of said stop is that it is backwardly and forwardly movable, and it consists, as here shown, of a short block loosely pivoted at its rear end to a depending lug, *s*, attached to the lower rear margin of the head *D*² of the pointing-die lever *D*. In this construction of the stop *S* its free end rides on the die *I*, and by reason of the relatively-elevated position of the axis of motion on the part of the lever *D*, the lower part of the head *D*², when raised and lowered, has a forward and backward movement by which the end of the stop is advanced and retreated, though to a less extent, because only the rear end of the stop is depressed. After acting in its position to arrest the blank, the stop is thus retreated or drawn toward the rear of the machine as the pointing-die lever descends, and by this movement it is taken out of the way of the pointing die *I* and also of the metal when the latter is elongated under the compressive action of the pointing-dies. Obviously, a properly-movable stop may be otherwise actuated than as here shown, but the construction described is desirable, as being both simple and effective.

The relative movements of the spike-forming parts are as follows: The blank-rod being brought to rest against the stop *S* in its more advanced position, the cutter *E*² first descends and severs the blank from the rod close to the heading-die *H*. When thus severed, the blank drops upon the projection *f*⁶ and upon the stationary pointing-die *I*. When in this position, the blank is quickly grasped between the dies *F*⁵ and *F*⁶ by the descent of the latter, as already described. As soon as the blank is thus seized between the dies *F*⁵ and *F*⁶ the cutter *E*², which has already severed the blank and has been for a moment stationary, still further descends, and by the rear bevel of said cutter the end of the blank which protrudes in front of the dies *F*⁵ and *F*⁶ is bent or forced downward in front of the said dies, so as to place the metal in proper position to form the head. Simultaneously with or immediately after the second downward movement of the cutter the movable dies *I*¹ and *I*² are brought down upon the point of the blank and give to the latter the desired shape, according to the particular form of said dies. Having formed the point of the spike, the dies *I*¹ and *I*² at once rise and immediately thereafter the dies *F*⁵ and *F*⁶ are carried forward by the movement of the traveler *F* so as to bear the downwardly-bent metal of the blank against the heading-die *H*. The dies *F*⁵ and *F*⁶ thereupon are simultaneously retreated and opened or separated in the manner

already set forth, and as soon as the spike is released therefrom the clearing-rod L is thrown inward and the finished spike is thrust out of the dies and allowed to fall through the space

5 between the arms F⁴.

Obviously the dies I, I' and I² may be constructed to give any desired form to the point of the spike. In the present case they are, as above stated, intended to form a spike having
10 a triangular shank for the greater portion of its length, and a point or edge located near the outer face of the spike, as indicated in Fig. 7^a. In constructing this spike-point, which has an inclined projection or rib, *t*, the die is correspondingly recessed, as indicated at *t'* in Fig. 7.
15 This recess *t'*, which forms the rib *t* upon the spike, makes the forward movement of the spike, as effected by the traveler F, essential, or at least important, in order to permit the spike
20 to be discharged from the machine quickly and in a horizontal direction by the laterally-clearing rod L, for, obviously, unless the spike is first drawn out of the recess *t'* a side push upon the spike by the clearing-rod L would throw
25 the head off the projections *f*⁵ of the die F⁶, but would not simultaneously force the point out of its place between the pointing-dies. In forming ordinary-shaped spikes, however, which are destitute of the rib *t*, this forward
30 movement is not essential to the proper discharge of the spike by a laterally-acting clearing-rod, L, though even in that case desirable to more promptly and freely discharge the spike.

35 Referring now more particularly to Figs. 7 and 4^a, there is here shown an especial form of the stationary pointing-die I, which has novel features of construction and certain advantages in operation—that is to say, said die is made in
40 two parts, I¹ and I⁴, both preferably made of steel and secured in the recessed and angle-shaped casting J by a clamping-bolt, I⁵, or other suitable means. The lowermost part, I¹, is made longer than I⁴, and is provided with a shoulder, *t*⁴, against which the adjacent end of the part I⁴ abuts. The working end or bearing-surface of the part I⁴ is usually subject to greater wear than the remaining part of this die, and may, in the construction described, be
50 renewed or changed at pleasure. Though generally termed a "pointing-die," it will be understood that the horizontally-projecting portion of the die I (or in Fig. 7 the portion of the part I¹ in advance of the shoulder *t*⁴) and the opposing die I' are intended to bear upon the upper and lower surfaces of the blank near its point for the purpose of straightening it. Being adjusted perfectly in line with the bearing-surfaces of the dies F⁵ and F⁶, and constructed to enter
60 between the rearward projections of these latter dies, the shank of the spike is made perfectly straight and of the desired size throughout its length at the same time that it is being pointed. The movable pointing-die I² is preferably of uniform diameter between its front
65 and rear faces throughout its length, in order

that in re-forming its lower or working face after it has become worn it need be ground only on its end. Said working face of the die I² may obviously be given any desired inclination or form. In the present case it is constructed with a slight incline or bevel to co-operate with the working face of the opposing die I, to produce a spike-point having its cutting-edge very near to the rear face of the spike; but it may be more inclined in a machine calculated to make the usual form of spike-point, wherein the cutting-edge is about
70 midway of the spike-shank.

Next will be described a practicable form
80 of automatic feed for carrying the blank-rod into the machine. Fig. 8 is a top or plan view of this device, and Fig. 9 is a side elevation, Fig. 10 being a detail of one or two suitable guides by which the reciprocating
85 crab or gripping device is guided. In said figures, N is a vertical lever, pivoted to the frame of the machine by means of a horizontal pin passing through said lever, and through lugs *n*, secured to the front margin of the opening A² in the bed at the point indicated
90 in Fig. 2, and opposite the cam No. 6 on the shaft B. Said lever rises to a point above the bed A above the level of the elevation A⁴, in which is set the heading-die H. Upon said elevation A⁴, and upon either side of the die H, are bolted two opposite guides, N', having their inner or proximate faces grooved and parallel and arranged in the direction in
95 which the rod is to be fed. Within these guides is fitted a slide, N², beneath which room is provided for the passage of the blank-rod, and upon said slide are pivoted two horizontally-movable jaws, N³ N³, having their points directed toward the working-dies and formed
105 to grasp the blank-rod R. To the slide N², and at a point, *n'*, between the axis and the gripping ends of the jaws N³, is pivoted a transverse horizontal lever, N⁴, connected with the cam-lever N by a pitman, N⁵.
110 Through oblique slots *n*² in the lever N⁴ rise pins *n*³, affixed to the jaws N³ of the crab, so that when the lever N⁴ is vibrated upon its pivotal point *n'* its action will be to first open the jaws of the crab by movement of the pins
115 N³ in the slots *n*², and when said pins strike the ends of the slots, to thereafter carry the crab bodily forward with its jaws remaining open. In this movement the crab is carried along the stationary blank-rod R as far as
120 necessary, or as provided in the cam No. 6, and in the return vibratory movement of said lever N⁴ the jaws are first closed upon the blank-rod R, and then the crab, together with the rod, is drawn forward, carrying the
125 rod to a proper position between the forming-dies. As hereshown, the cam No. 6 gives only the outward movement to the crab, the inward movement being obtained by means of a spring, N⁶, arranged to throw the lever N
130 into contact with or in opposition to the said cam 6.

In the use of an entirely positive automatic feed device the stop S may be dispensed with; but in the employment of a form of feed-mechanism in which the forward movement of the blank-rod is effected by a spring—such, for instance, as that herein shown—the stop S may advantageously be retained for the purpose of insuring the accurate location of the point end of the blank over the die. In that form of feed device herein specifically described, in which motion is given by cam No. 6 and the spring to the gripping device or crab through the medium of the lever N⁴, which also operates to open and close the gripping-jaws, the position of the outer end of the said lever, and consequently of the crab and blank-rod carried thereby, at the forward limit of their movement may sometimes be varied slightly on account of variations in the distance apart of the gripping-jaws, caused by slight irregularities in the thickness of the blank or by the jaw indenting the heated metal to a greater or less extent as the latter is more or less soft. For this reason the use of the stop S is of especial advantage in connection with this form of feed device, inasmuch as by its employment the forward movement of the blank-rod may be arrested at the same point at every reciprocation thereof.

It is obvious that in a machine for forming an ordinary spike, or one requiring no recess in the pointing-die, said pointing-die may be horizontally movable with the traveller or with the die F⁵, and that in the present machine the horizontal part I³ of the pointing-die (if made in two parts) may be thus movable with the traveler. In other words, it may form a rearward extension of the projection f⁵ of the die F⁵, reaching to the pointing-die proper, I¹.

I claim as my invention—

1. The combination, with a stationary heading-die, of the mechanism for grasping the blank, the mechanism for carrying the blank endwise and forcing it against the heading-die to upset the end of the blank, and the mechanism for pointing the blank, substantially as described.

2. The combination, with a stationary heading-die, of grasping-dies for the blank, the mechanism for carrying the grasping-dies and blank toward and forcing the blank against the heading-die, and the mechanism for bending the end of the blank into position to form a laterally-projecting spike-head, substantially as described.

3. The combination, with grasping-dies adapted to seize the blank between its ends, of a stationary heading-die, also serving as a fixed cutter, a movable cutter constructed to sever and also to bend the blank, and the mechanism for carrying the grasping-dies and the blank toward, and forcing the blank against the stationary heading-die, substantially as described.

4. The combination, with the grasping-dies for holding the blank, stationary and movable pointing-dies, and the mechanism for actuating the movable pointing-dies, of a stationary heading-die, and the mechanism for carrying the grasping-dies and the blank toward and forcing the blank against the stationary heading-die, substantially as described.

5. The combination, with the stationary cutter and heading-die and the stationary and movable pointing-dies, of the traveler F, a grasping-die, F⁵, fixed to the traveler and provided with a projection, f⁵, a grasping-die, F⁶, movably secured to the traveler and provided with a projection, f⁶, the mechanism for reciprocating the traveler, so as to carry the dies F⁵ and F⁶ back and forth between the pointing-dies and the heading-die, and to force the blank against the heading-die, and the means for actuating the movable die F⁶, substantially as and for the purposes set forth.

6. In combination with the stationary heading-die H, the stationary die I, constructed to form the point and to support the shank of the spike, an opposing pointing and straightening die, I², grasping-dies F⁵ F⁶, constructed with opposing upper and lower projections, f⁵ and f⁶, respectively, the means for moving the said grasping-dies toward the heading-die, and the means for moving the die F⁶ in the laterally-inclined direction set forth, substantially as and for the purpose stated.

7. In combination with the stationary heading-die, the traveler F, provided with downwardly and laterally projecting arms F⁴, the die-support F⁷, provided with an arm, F⁸, pivoted to the lower ends of the arms F⁴, the die F⁵, fixed to the traveler and provided with a projection, f⁵, the die F⁶, secured to the die-support F⁷, and provided with a projection, f⁶, the means for reciprocating the traveler, whereby the blank is forced against the heading-die, and the means for vibrating the arm F⁸, substantially as described, and for the purpose stated.

8. In combination with the heading-die, the traveler F, provided with depending arms F⁴, the die-support F⁷, provided with an arm, F⁸, pivoted to said arms F⁴, grasping-dies F⁵ and F⁶, secured, respectively, to the traveler and the die-support, the rod F¹⁰, expanding spring f⁴, the means for throwing the arm F⁸ in opposition to the action of the spring, and the means for reciprocating the traveler, substantially as described.

9. In combination with the heading-die, the traveler F, provided with depending arms F⁴, the die-support F⁷, provided with an arm, F⁸, pivoted to said arms F⁴, dies F⁵ and F⁶, secured, respectively, to the traveler and die-support, the means for lifting the die-support, a wedge engaged with the traveler and die-support for forcing the latter downward and inward, and the means for reciprocating the traveler, substantially as described.

10. In combination with the pointing-dies,

the stationary heading-die, and the locally-stationary cam-shaft B, a die-carrying traveler, and laterally-movable die-support, grasping-dies F⁵ and F⁶, mounted, respectively, upon the traveler and die-support, a suitable cam or cams on the shaft B for reciprocating the traveler, so as to force the blank held in the grasping-die against the heading-die, the means for raising the laterally-movable die-support with its die, a wedge for depressing the die-support, a slide connected with said wedge, and a cam on the shaft B for actuating the slide, substantially as described.

11. The combination, with the machine-bed, cam-shaft, and frame-uprights, of the stationary heading-die, the stationary pointing-die, the pointing-die lever E, die-carrying traveler F, cams on the shaft B for actuating the lever E and for reciprocating the traveler, so as to force the blank against the heading-die, and the devices for engaging the said lever and the traveler with the cams, substantially as described.

12. The combination, with the machine-bed, cam-shaft, and frame-uprights, of the stationary heading-die, stationary pointing-die, die-carrying traveler, a laterally-movable die-support carried by the traveler, grasping-dies mounted upon the traveler and die-support, a pointing-die lever, a cutter-lever, a series of cams on the cam-shaft for actuating the levers mentioned and for reciprocating the traveler, so as to force the blank against the heading-die, and the means for actuating the laterally-movable die-support, substantially as and for the purpose set forth.

13. The combination, with the pointing-dies, and with grasping-dies which hold the blank from longitudinal movement while being pointed, of a stop for arresting the blank, having a backward and forward movement, and means, substantially as described, for feeding the blank to said dies, substantially as and for the purpose set forth.

14. The combination, with the stationary and reciprocating pointing-dies, of a stop pivoted to the removable die-carrier, and riding at its free end upon the stationary die, and means, substantially as described, for feeding the blanks to said dies, substantially as and for the purpose set forth.

15. In combination with a stationary pointing-die and an opposing reciprocating pointing-die, a movable stop constructed to advance when the movable die is raised, and to be retreated by the descent of said movable die, and means, substantially as described, for feeding the blanks to said die, substantially as described.

16. In combination with a pointing die or dies having a recess, as *t*, traveling mechanism for drawing the spike longitudinally preliminary to its discharge from the machine, substantially as described.

17. In combination with a pointing die or dies having a recess by which a longitudinal

rib or projection is formed on the spike, a stationary heading-die, and the means for carrying the blank longitudinally clear of the recess of the pointing-dies, and by the same motion forcing the blank against the heading-die, so as to form the spike-head, substantially as described.

18. In combination with the heading-die and the pointing and straightening die I, constructed to support the blank on its lower surface only, and with an opposing die or dies, I' I', grasping-dies F⁵ F⁶, constructed to bear upon the sides of the blank throughout the whole or a greater part of its length, and the means for moving the grasping-dies whereby the blank is forced against the heading-die, substantially as described.

19. In combination with the pointing-die I, constructed to support the blank on its lower surface only, and a die opposed to the die I, the movable grasping-dies F⁵ F⁶, provided, respectively, with the opposing lower and upper projections, *f*⁵ *f*⁶, at their front end, and extended to bear upon the sides of the spike-shank throughout a whole or a greater part of its length, substantially as described.

20. In combination with a support, the die I³, resting in a horizontal position thereon and provided with a shoulder, *i*⁴, and the pointing-die proper, I¹, resting upon the die I³ and against the shoulder *i*⁴, together with the means for securing the parts removably in place, substantially as described.

21. In combination with the cam-shaft B and heading and pointing dies, the traveler carrying grasping-dies, the yoke F³, connected with the traveler and provided with projection F², and the cams 3 and 4 on shaft B, whereby the traveler is actuated and the blank forced against the heading-die, substantially as described.

22. In combination with the straightening and pointing dies and with the movable cutter, the heading-die constructed with a recess, *h*¹, for guiding the blank-rod, substantially as described.

23. In combination with the movable cutter, the part H, forming the stationary cutter and heading-die and provided with a guiding-recess, *h*¹, substantially as and for the purpose set forth.

24. In combination with spike-forming dies and a rotating shaft, B, the rod-feeding jaws N³, a sliding plate to which said jaws are pivoted, a transverse lever, N⁴, pivoted to the sliding plate and provided with oblique slots *n*², pins *n*³ on the jaws engaged with said slots, the means actuated by the shaft B, constructed to throw the lever N⁴ farther than its limit of vibration, whereby the jaws are given a bodily movement after being opened and closed, substantially as and for the purpose set forth.

25. In combination with a recessed pointing-die and grasping-dies operating to withdraw the spike clear of the said recessed die, the means constructed to discharge the spike

laterally after it has been withdrawn from the recessed pointing-die, substantially as described.

26. In combination with the traveler F and
5 the heading and pointing dies, the means for actuating the traveler so as to carry the blank forcibly against the heading-die, the rod L, mounted on the traveler, the spring L', lever K, and cam K³, substantially as and for the
10 purposes set forth.

27. The combination of a movable cutter, a stationary cutter constructed to serve also as a heading-die, pointing-dies that preserve their

distance from the heading-die, and movable grasping-dies intermediate to the pointing and
15 heading dies constructed to carry the blank forcibly against the heading-die after said blank is pointed, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of
20 two witnesses.

WILLIAM KOPLIN.

Witnesses:

M. E. DAYTON,
W. C. ADAMS.