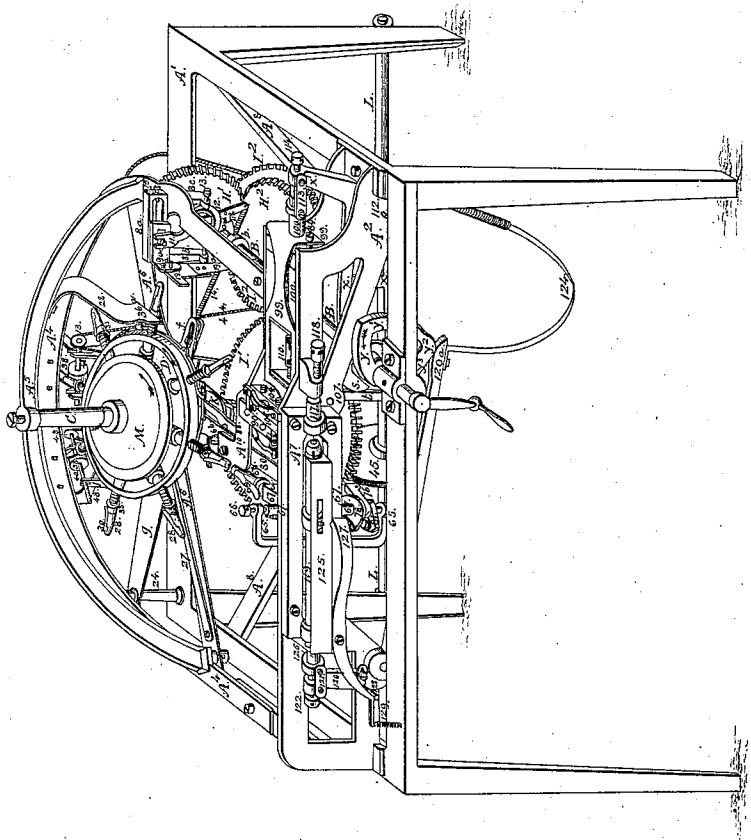
Sheet 1 - 5 Sheets.

J. I. Howe,

Pin Machine,

No. 2,013. Patented Mar. 24, 1841.



Witnesses;

Sheldon Parfitt
D. Saunders

Inventor;

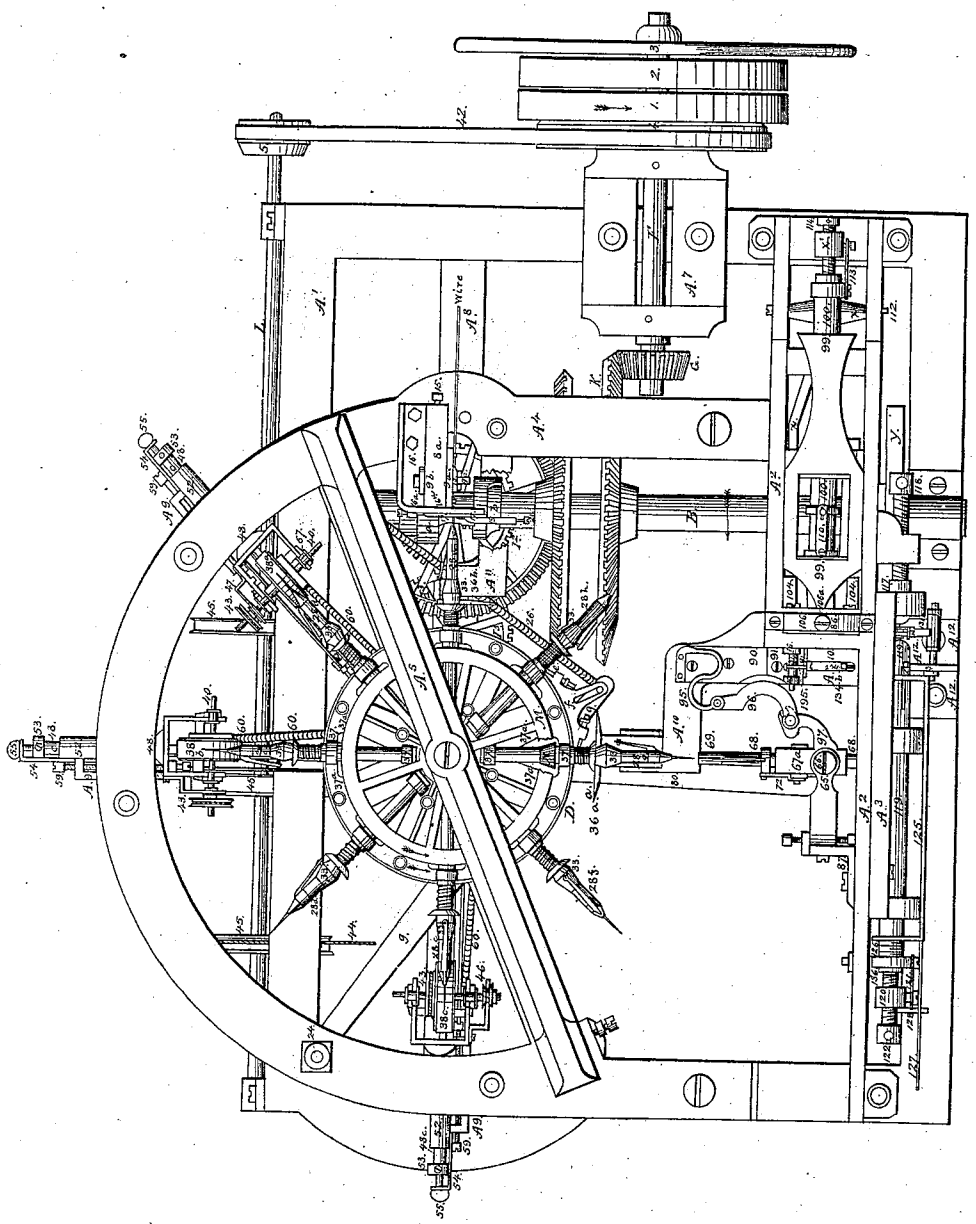
Jno. I. Howe

Sheet 2-5 Sheets.

J. I. Howe,

Pin Machine,

No 2,013. Patented Mar. 24, 1841.



Witnesses;

Sheldon Pasfield
E. A. Saunders

Inventor;

Jno. I. Howe

Sheet 3 - 5 Sheets.

J. I. Howe,

Pin Machine,

No. 2,013. Patented Mar. 24, 1841.

Fig. 1.

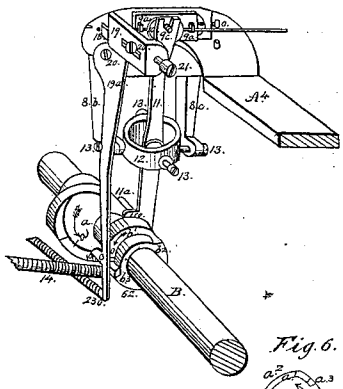


Fig. 3.

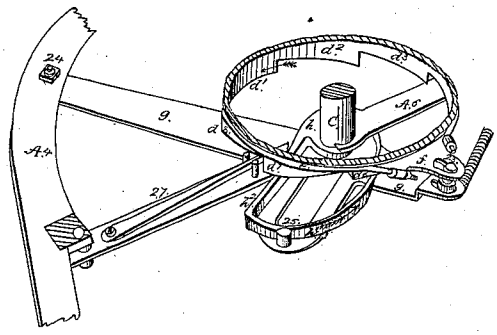


Fig. 6.

Fig. 4.

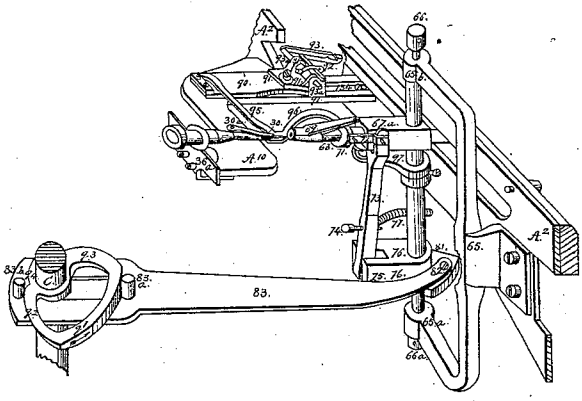


Fig. 2.

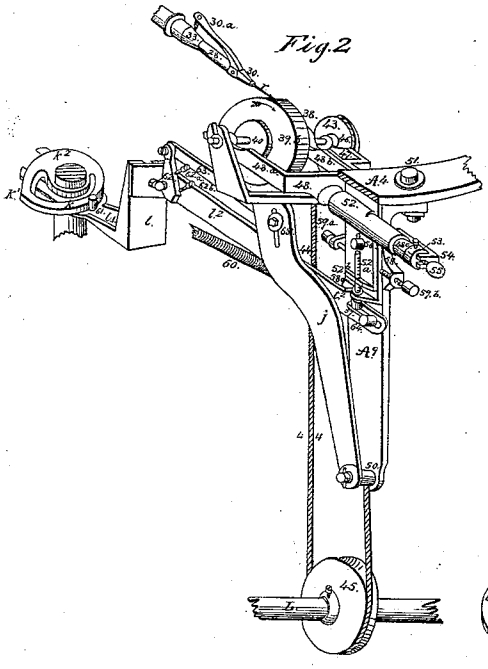
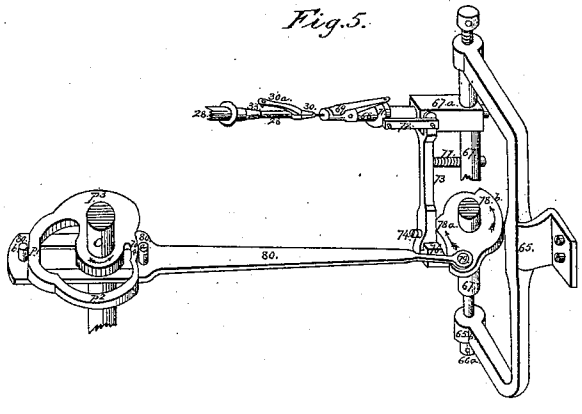


Fig. 5.



Witnesses;

Sheldon Babcock
E. Adams

Inventor;

Thos. J. Howe

Sheet 4 - 5 Sheets.

J. I. Howe,

Pin Machine,

No. 2,013. Patented Mar. 24, 1841

Fig. 2.

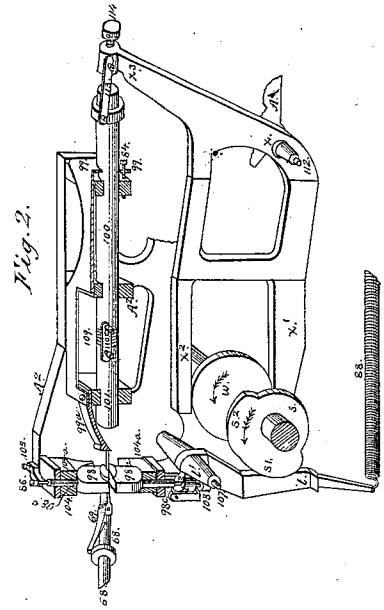


Fig. 3.

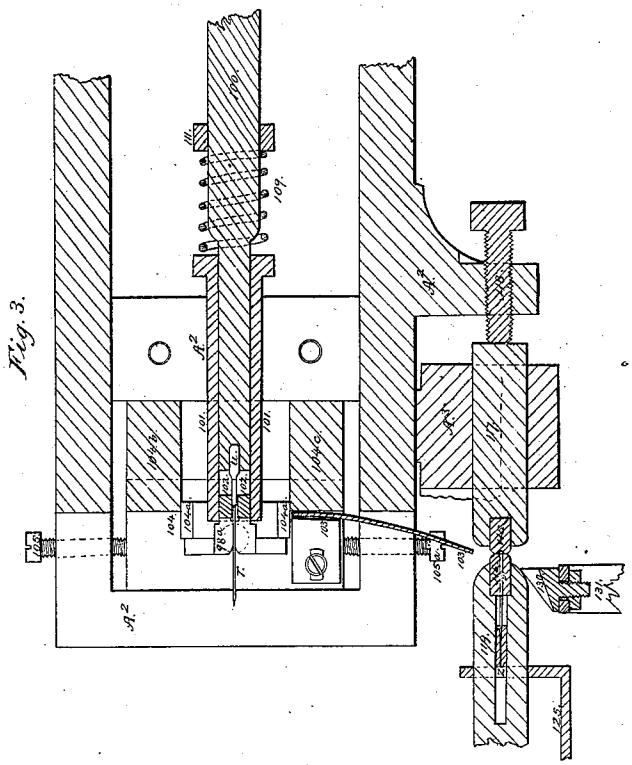


Fig. 1.

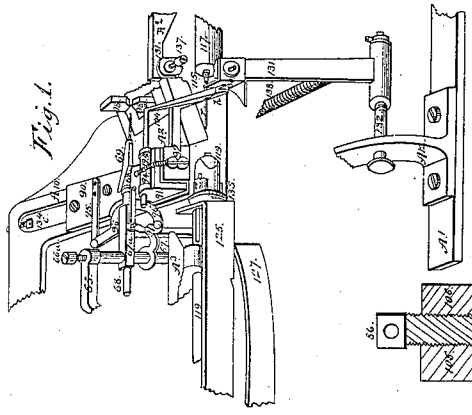
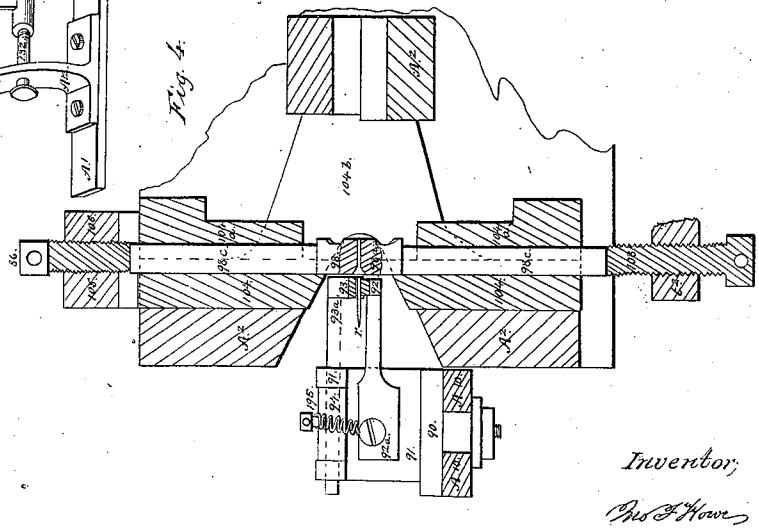


Fig. 4.



Witnesses;

Sheldon Bassett
A. Saunders

Inventor;

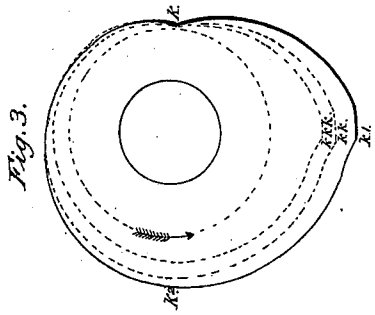
Jas. I. Howe

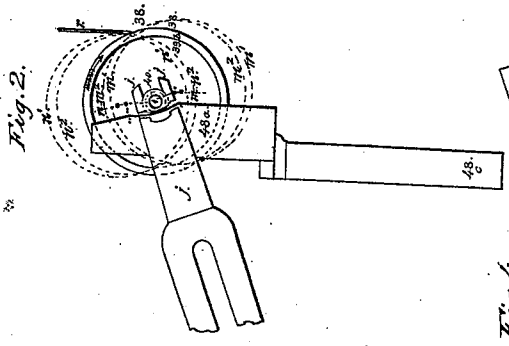
Sheet 5 - 5 Sheets.

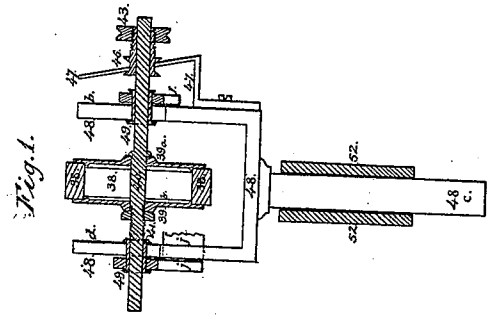
J. I. Howe,

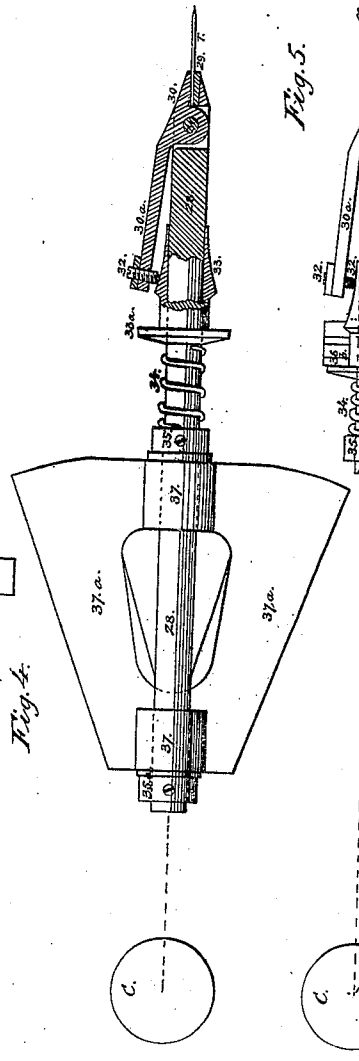
Pin Machine,

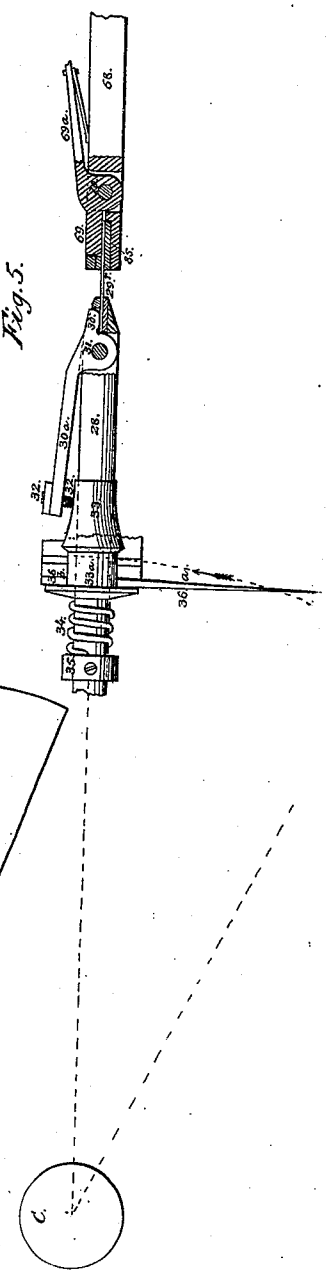
No. 2,013. Patented Mar. 24, 1841.











Witnesses;

Sheldon Babcock
E. Saunders

Inventor.

Jas. I. Howe.

UNITED STATES PATENT OFFICE.

JOHN I. HOWE, OF DERBY, CONNECTICUT.

MACHINE FOR MAKING PINS.

Specification of Letters Patent No. 2,013, dated March 24, 1841.

To all whom it may concern:

Be it known that I, JOHN I. HOWE, of the town of Derby, in the county of New Haven and State of Connecticut, have invented a new and useful machine for making pins of brass wire or of wire of other metal, by means of which the wire, having been properly straightened and placed in a coil upon a suitable reel and having one of its ends introduced in a proper manner into said machine, is in successive portions drawn in and converted into pins by the action of the machine, each pin so made by the machine consisting of a single piece of metal or wire, the head of the pin being upset or raised and formed at one end and the other end being sharpened in a suitable manner to form the point, and that the following is a full and exact description thereof and of the manner of constructing and using the same, reference being had to the accompanying five sheets of drawings, which make a part of this specification.

The individual parts of the machine are marked in the drawings with capital letters, with small letters, and with numbers respectively, and the same marks of reference refer in all cases to the same or similar parts. The drawings are made on a scale of about one fourth the actual dimensions, excepting such of the figures as are otherwise marked, and designated, by descriptions written near them on the sheets on which they are drawn.

I shall first describe, under several distinct heads, the individual parts and minor combinations, which being united into one general combination constitute the entire machine and explain their several offices and actions, and then explain the general combination, together with the combined actions or movements by which, as they take place successively or simultaneously, the machine performs its work.

Of the fixed frame.—The fixed frame is of cast iron, and may for convenience be described under several divisions, viz., an upright square portion A^1 in which are formed the bearings of the main axis B, and which supports all the other parts of the machine. The heading frame A^2 which is placed upon the top of and at one side of the square portion A^1. It has two vertical sides, which are connected by several cross portions extending horizontally across from one to the other of said vertical parts. It furnishes bearings for most of the parts employed in making the heads of the pins, and will be further described in connection with the description of the last named parts.

A^3 is a part accessory to the heading frame A^2, and is fastened by screws upon the outer face of the outer vertical portion of said heading frame; A^4 a semicircular, horizontal portion, attached to the inner side of the aforesaid heading frame. Its upper face is about eight inches above the center of the main axis B and about one inch below a horizontal plane, in which the several operations upon the pin, in the process of its formation, are performed. It supports the feeding apparatus, the cutter for cutting off the wire, and the several mills for pointing the pins. It has an arch A^5 which extends from one side to the other of said semicircular portion, over its center and holds a center screw or pivot for the upper end of the vertical shaft C. A girt A^6 extends across beneath said semicircular portion immediately under said arch, which holds a spring and catch for fixing and detaining the revolving table D during the intervals between the movements of said table. In the middle of said girt is a hole through which the shaft C, and also a portion of a hub on the under side of the table D, pass. A^7 furnishes bearings for the driving shaft F. An inverted arch A^8 extends across from one end to the other of the square portion A^1 to the under side of the ends of which it is attached. It supports the step of the vertical axis C, and also the axis of a bevel and spur wheel which serve as intermediate gearing to connect the shafts B and C. There are some other fixed parts which will be described in connection with moving parts with which they are associated.

Of the driving power.—The machine is put in motion through a driving shaft F, which has its bearings formed in the portion A^7 of the fixed frame shown in the plan Sheet II. The shaft F is placed at right angles to the main shaft B, and both of said shafts are in a horizontal position in the same plane with each other. On the outer end of the shaft F, are fixed a fast pulley 1, a loose pulley 2, a fly wheel 3, and a pulley 4, for driving the shaft L which carries the pulleys 45 for driving the pointing mills, and on the inner end of said shaft F is fixed a bevel pinion G. The aforesaid bevel pinion G works into the

bevel wheel K which is fixed on the shaft B, said wheel having four times the number of teeth of the pinion G, so that four revolutions of the driving shaft F communicate one revolution to the shaft B. The horizontal shaft B is connected with the vertical shaft C, by bevel and spur gearing, so that both the said shafts revolve in the same time in the direction indicated by the arrows on the respective shafts, as is shown in the perspective drawing Sheet 1. The miter bevel wheel H^1 on the shaft B works into the miter bevel wheel H^2, which has its axis placed perpendicularly beneath the shaft B. On the axis of the bevel wheel H^2 is fixed a spur wheel I^2 which works into a similar spur wheel I^1, which is fixed on the vertical shaft C, as is represented in Sheet I. But in Sheet 2 the bevel wheel H^1 is represented as facing in an opposite direction on the shaft B from that in which it is shown in Sheet I, in which case an intermediate spur wheel I^3 must be introduced between the wheels I^1 and I^2 in order to turn the shaft C, in the right direction, and the spur wheel on the axis of the bevel wheel H^2, and that on the axis C must have each the same number of teeth. The pulley 4, Sheet II, is connected by a belt to the pulley 5 on the shaft L for the purpose of communicating an accelerated rotary motion to the shaft L. On the shaft L are the pulleys 45 which are respectively connected by bands 44 with the pulleys 43 on the arbors or spindles of the mills or revolving circular files, 38, by which the points of the pins are ground and sharpened, for the purpose of communicating the necessary rapid rotary motion to said mills.

Of the feeding and cutting apparatus.—Fig. 1, Sheet III, of the drawings is a perspective view of the combined apparatus for feeding in and cutting off the wire, with a portion of the semicircular horizontal part of the frame A^4, to which the principal parts of said apparatus are attached; other views of said apparatus are represented in the perspective, Sheet I, and in the plan, Sheet II. The fixed portion of the feeding apparatus consists of a horizontal part, 8^a, and two arms 8^b and 8^c, depending in a perpendicular direction from the under side of said horizontal portion. The horizontal portion 8^a has an oblong opening through it extending in a horizontal direction from within, toward the shaft, C, outward. The two vertical surfaces of said portion, 8^a, are dressed straight and parallel with each other, and the two sides of the aforesaid oblong opening are also dressed straight and parallel with each other. A slide, 9^a, which rests against the front vertical face of the portion 8^a is connected through the said opening in 8^a, with a cap, 9^b, Sheet II, which rests against the back vertical face of the portion 8^a, and the portion by which the slide, 9^a, is connected with the cap, 9^b, is so formed and fitted into said opening as to allow said slide to move freely forward and backward, but not to turn or move in any other direction. The slide, 9^a, has a stud, 9^c, standing out horizontally at right angles to and near the center of its face. There is a small hole made horizontally through said stud close to the face of the slide, through which, and also through an eye formed for the purpose, near each end of the slide, the wire is introduced in a horizontal direction from right to left. There is a steel cap, 10, fitted by a hole in its center, on the stud, 9^c, behind which the wire is introduced as aforesaid, in the manner represented in Fig. 1, Sheet III.

The lever, 11, of the feeder has a fork at its upper end to receive the stud, 9^c, and near its lower end it has the stud, 11^a, and the plate, 11^b, to receive the action of the feeder cam, *a*. The lever, 11, is jointed to the extremities of the two arms, 8^b and 8^c, of the feeder frame, 8 *a b c*, by the ring 12 and the four center or pivot screws 13, Fig. 1, Sheet III, so as to furnish said lever with two horizontal axes intersecting each other at right angles in the manner of a universal joint, by means of which the forked end of said lever is allowed to be alternately pressed against the cap 10, and then removed from it, at the same time that it has a reciprocating motion forward and backward, for the purpose of carrying forward the feeder 9^a in the act of introducing the wire and then carrying said feeder back, in order to its introducing another portion of wire. The cam *a*, by which the movements and actions of the feeder are produced is represented in Fig. 6, Sheet III. Said cam *a* (revolving in the direction indicated by the arrow) acts by the face, a^2, on its periphery against the stud, 11^a, of the lever, 11, to carry forward the feeder, 9, and by the face, a^3 on its periphery to retain said feeder for a short period in the advanced position to which it had been previously carried, the face a^3 of said cam being concentric with the axis B, on which said cam is fixed. Said cam, *a*, has a rib or raised portion, a^1, on its side, by which it acts against the plate, 11^b, of the lever, 11, to press the forked end of said lever against the cap 10 of the feeder, in order to grasp the wire in the act of feeding it into the machine. A spiral spring, 14, is attached to the lower end of the lever 11, below its stud and plate aforesaid, and to some part of the fixed frame, so as to draw obliquely inward that end of said lever, and to retract it as soon as the cam, *a*, recedes after having performed its aforesaid actions, respectively, on said stud 11^a and plate 11^b. A gage screw 15 is fitted into the exterior end of

the portion 8^a of the feeder frame against the point of which the slide of the feeder stops when it is carried back in the manner above described by the spring 14. By turning the aforesaid gage screw 15 out or in the length of the portion of wire introduced at each operation of the feeder may be graduated according to the proposed length of the pin. When in the rotation of the cam *a*, its rib a^1 comes against the plate 11^b of the lever 11, it crowds the lower end of said lever back in the direction of the length of the shaft B so as to press its upper or forked end against the cap 10, pressing said cap against the wire, so that the wire is embraced and firmly held between said cap 10 and the face of the slide 9, and while the wire continues to be so held the rising face on the periphery of the cam *a*, comes against the stud 11^a, of the lever 11, crowding the lower end of said lever back in a direction at right angles to the length of the shaft B and consequently carrying forward the upper or forked end of said lever, which holding on to the stud, 9^c, of the feeder, by the fork in its end, carries forward the feeder holding the wire in the manner above described. (Note: In the regular operation of the machine, when the wire is carried forward by the feeder, the end of the wire enters one of the "pointing chucks" herein after described, which is in readiness to receive it, and in order to insure the entrance thereof a guide is placed near the extremity of said chuck. Said guide is in the form of a hollow cone having its apex directed toward the chuck and its base toward the feeder. There must be a perforation at the apex of the cone to allow the wire to pass through in a straight line from the feeder to the chuck, and there must also be an opening made in its side to allow the chuck to carry the pin (or wire) out laterally. Said guide may be attached to the "cutter stand" or any convenient part of the fixed frame.) Before the concentric face a^3, before described, of the cam, *a*, leaves the stud 11^a the rib a^1 of said cam will leave the plate 11^b so as to allow the spring 14 to retract the forked end of the lever 11 from the cap 10, and afterward said high concentric part of the cam, *a*, passing away from the stud, 11^a, will leave the feeder free to be carried back by the action of the spring 14, till it is stopped by coming against the gage screw 15.

The apparatus for cutting off the wire and also holding it after it has been introduced by the feeder while the feeder is going back and renewing its grasp on the wire, in order to introduce another succeeding portion of wire, is supported by and consists in part of an adjustable frame piece or stand 16, which is fastened by a screw on the top of the portion A^4 of the fixed frame, close behind the frame 8 of the feeding apparatus, as represented in the plan Sheet II. At the interior extremity of the stand 16, it has a portion 16^a, which extends across in front of the interior extremity of the portion, 8^a, of the feeder frame, furnishing in front toward the vertical shaft C (or the center of the revolving table D) a vertical plain surface at right angles to the line in which the wire is fed into the machine. To the aforesaid vertical face of the portion 16^a, of the cutter stand is fitted a steel plate 17. The plate 17 has a hole through it of a suitable size and in a proper situation to let the wire pass through it in a straight line from the feeder to the pointing chuck, into which chuck the wire enters, in the manner shown in the plan Sheet II, previous to a portion of it being cut off to form a pin. A steel cutter, 18, is fitted into a groove or socket in the cutter stock, 19, so as to admit of its being adjusted and fixed therein by the screws 20 and 21 and to cause the cutting edge of said cutter to lie flat against the plate, 17. The cutter stock 19 is jointed to the vertical portion, 16^a, of the cutter stand by means of a center screw 22, so that 19 forms the short arm of a lever of which 19^a, forms the long arm. A small projection or plate, 19^c, extending from the edge of the arm, 19^a, of said lever, rests upon the periphery of the cutter cam, *b*, and a stand, *o*, standing out laterally from said arm, 19^a, at right angles to the plane of its motion on its center, 22, rests against the side of said cam *b*, on which side the acting parts of said cam are formed. The cam, *b*, is circular and concentric with the shaft B, on which it is fixed, and has its acting parts formed on the side of it next the aforesaid stud, *o*, of the lever 19, as represented in Fig. 1, Sheet III.

b^1 is a recess or low part which is connected by an inclined portion at one of its extremities to the raised part, b^2, and at its other extremity to the tooth or pivot, b^3. The portion or face b^2 is a plain surface coinciding with the plane in which the cam *b* revolves, and the tooth b^3 is a wedge shaped projection raised upon one extremity of the face b^2.

A spiral spring, 230, which connects the extremity of the arm, 19^a, with the fixed frame, serves to draw said arm in a direction contrary to that in which it is moved by the action of the cam *b*, and retract the cutter immediately after its action in cutting off the wire.

The cam *b* must be adjusted on the shaft B, in reference to the feeder cam, *a*, so that its recess or low part b^1 will be opposite the stud *o* of the lever 19 during the time in which said cam, *a*, is engaged in carrying forward the feeder to feed in the wire, and while the cam, *a*, continues to hold the feeder in its advanced position, and before

the feeder relaxes its hold upon the wire, in the manner before described, the face b^2 of the cutter cam must arrive at the stud o of the lever 19, so as to cause the cutter, 18, to close upon the wire and hold it without cutting it off, and while the face, b^2, of the cutter cam is passing the stud, o, and before the tooth, b^3, reaches said stud, o, the feeder must release its grasp on the wire, return to its retracted position, and again renew its grasp on the wire, and then before the feeder begins to advance, and while it remains stationary in its retracted position, the tooth, b^3, of the cutter cam must pass the stud, o, by which the cutter 18 will be suddenly further advanced to cut off the wire close to the face of the plate 17, against which the flat side of the cutter plays, and by the reaction of the spring, 230, the stud, o, will be drawn against the low part, b^1, of the cutter cam so as to retract the cutter 18 out of the way to allow the feeder to introduce another succeeding portion of wire. The length of wire fed in and cut off at each operation of the feeding and cutting apparatus is equal to the length of the pin to be made, and a portion of wire sufficient, by being raised or upset and properly compressed between suitable dies, to form the head of the pin.

Of the pointing chucks and revolving table and other parts accessory to their movements.—In the process of sharpening the points of the pins made by the machine herein described the piece of wire is held and turned around by a chuck formed at the extremity of a revolving axis, in a manner similar to that in which a piece of work is held and turned in the chuck of a turning lathe, but the end of the wire is reduced to the requisite tapering and pointed form by the grinding action of circular revolving files and not by the point or edge of a tool, as in the common operation of turning. There are eight such chucks, mounted in suitable bearings on a revolving table D. The revolving table D is placed in a horizontal position on the vertical shaft C, as is shown in Sheets I and II and Fig. 3, Sheet III. It has a hole in its center fitted to said shaft C, so as to allow said shaft to revolve while the table is at rest and to allow said table to move around said shaft as its axis or center of motion when said table moves around by an intermitting motion. The upper horizontal face of said table furnishes plane surfaces to which are fitted and fastened by screws the bearings or boxes of the pointing chucks, 28, and said table has on its back or under side a hub which rests upon a collar on the shaft C and which is also fitted into a hole in the middle of the girt A^6. It has on its under side, near its circumference, a rim extending vertically downward, which is divided at its lower edge into eight equal divisions or teeth, similar to saw teeth, as is shown in Fig. 3, Sheet III. In said Fig. 3 the above described rim is represented in section, with all the other parts of the table unmoved in order to show the aforesaid divisions or teeth which are marked in the figure d 1 to 8. There is a semicircular groove formed around the circumference of the aforesaid rim above the bottoms of its teeth, to receive the clip band e, f. The clip band e, f, is formed of a rod of round iron or wire, e, of a size to fit the aforesaid groove. The rod e has a screw cut at each of its ends and is bent so as to fit as a band into said groove around the rim of the table D, so as to embrace about three fourths of the circumference of said groove. The ends of said rod, e, (being straight are passed through eyes in the yoke f, and are secured in that situation by nuts which are screwed on to said ends of the rod e, in the manner shown in Sheets I and II and Fig. 3, Sheet III. The yoke, f, is placed in a horizontal position and presents toward the table D a concave side which is fitted to the groove in the rim of said table. Said yoke, f, has a vertical slot formed through it, the longitudinal center of which is in continuation of a right line extending horizontally outward from the center of the axis C. By means of a stud 23 which extends upward in a perpendicular direction through the aforesaid slot in the yoke f, from the end of the lever, g, to which said stud is attached, a connection is formed between said yoke, f, and said lever, g, so that when said lever, g, is moved, horizontally, to the right or left hand it communicates a corresponding movement to said yoke. The lever, g, is connected by a vertical axis, 24, to the fixed frame, as is shown at 24 in Sheet I and Fig. 3, Sheet III. It has a broad part in which is a slot or opening of sufficient dimensions to allow the shafts C to pass through it and to allow said lever to move forward and backward to a certain extent around its axis, 24. A stud 25 is attached to the broad part of the lever, g, in a suitable position to receive the action of the cam, h, which is fixed on the vertical shaft C. The cam, h, has two eccentric faces on its periphery— viz., the longer face, h^1, which extends around three fourths of the circle of its periphery, and the shorter face, h^2, which occupies one fourth of said circle. A spring, 26, connects the end of the lever, g, with the fixed frame and draws said lever in such a direction as to incline the stud, 25, of said lever inward toward the vertical axis C. In the machine herein described the cam h is placed beneath the lever, g, and the stud 25 is affixed to the under side of said lever. In Fig. 3 said cam, h, is represented above said lever and the stud, 25, affixed to its upper side in order to show the action of said cam upon said stud.

There is a spring catch, 27, attached to the girt, A^6, which allows the table D to move around freely in the direction of the arrow by yielding under the inclined faces of the teeth, *d*, of said table, but which prevents or arrests a retrograde movement of said table by springing up behind the perpendicular faces of said teeth and catching against one of said perpendicular faces if an effort be made to move said table in a retrograde direction.

The table D moves forward around the axis, C, in the direction indicated by the arrow marked on the rim, *d*, of said table as shown in Fig. 3, Sheet III, one eighth of a revolution at each revolution of the shaft, C. It occupies one fourth of the time of a revolution of the shaft C in making said movement, and it remains at rest during three fourths of the time of a revolution of said shaft C. The aforesaid alternate periods of motion and rest of the table, D, are produced by the above described combination, which is marked in the drawings referred to in the foregoing description with the following letters and figures, viz: C. D, *d* (1 to 8), *e*, *f*, 23, *g*, 24, A^1, A^4, A^6, 27, *h* (1 to 3), 25, 26, in the following manner. That is to say supposing all the parts of the aforesaid combination which are shown in Fig. 3, Sheet III, to be in the positions relatively to each other in which they are represented in said Fig. 3, and that the shaft C and the cam, *h*, are in the act of revolving in the direction indicated by the arrows, the faces, h^1, of the cam, *h*, advancing against the stud 25 of the lever, *g*, will carry back said lever, and with said lever the clip band, *f*, *e*, but the table, D, will be prevented from moving back along with the clip band, *e*, *f*, in consequence of the tooth d^7 of said table being arrested by the catch, 27. Consequently the clip band will slip around in the groove of said table D, and said table D, will remain stationary until the highest part of the cam *h*, shall have passed the stud, 25. But as soon as the face, h^1, shall have passed the stud, 25, and the receding face, h^2, be presented toward said stud, 25, the spring 26 will react and draw the lever, *g*, together with the yoke *e*, *f*, and the table D forward, and cause said stud, 25, to follow down the receding face, h^2, of the cam, *h*, until said stud reaches the lowest part of said cam, at which time the tooth, d^8, of the table D, will arrive at the position which was occupied by the tooth d^7, of said table during its period of rest, which immediately preceded its last described movement and the catch, 27, will spring up behind the perpendicular face of said tooth d^8. The face h^1 of the cam, *h*, will then begin to advance against the stud, 25, of the lever, *g*, and again carry back said lever with the clip band *e*, *f*, but the table D will be prevented from moving back with the clip, *e*, *f*, by the catch, 27, arresting the tooth d^8, and the table D will again remain at rest till the highest part of the cam *h*, shall have passed the stud, 25, when said table will again move forward one step in the manner above described, and so each revolution of the cam, *h*, will cause the table D to move around one step, and every eight steps will complete one revolution of said table.

The manner in which the spindles or revolving axes, 28, of the eight aforesaid pointing chucks are disposed on the table D is shown in Sheets I and II. Said axes, 28, must be so adjusted in their bearings on said table D, as to have their centers disposed at equal distances from each other around said table in the direction of radii proceeding from the center or axis around which said table revolves. The centers of all the axes, 28, must be in one horizontal plane and the extremities of the chucks formed at their outer ends must all be at an equal distance from the center of the axis C. The pins are held by said chucks, 28, so as to point outward from their extremities, each pin being held in a line continuous with the central line of the axis of the chuck by which it is held, in the manner shown in the plan Sheet II. In describing the movements and operations of said chucks in receiving, holding, turning, carrying and delivering the pins I shall consider the number, 28, as designating not only the axis of the chuck, but all the several parts of the chuck collectively with its axis.

The manner in which the rotary axes, 28, are fitted into their bearings is represented in Fig. 4, Sheet V. The two bearings 37, are formed upon and united with each other by the plate 37^a. The plate 37^a also serves the purpose of connecting said bearings, 37, to the table D, by means of binding screws and washers, two such screws being screwed into the table between each two of said plates 37^a, each screw having a washer upon it which overlaps the edge of each of the plates, 37^a, between which the screw is placed as shown in Sheet II. The axis, 28, is introduced into its bearings, 37, and is adjusted and secured in its place therein by two collars, 35 and 35^a, said collars being fastened by binding screws, as shown in said Fig. 4, Sheet V. The chucks, 28, have a continuous rotary motion given to them by the bevel wheel, M, on the vertical axis, C, working into a bevel pinion N, with which each of the axes 28, is furnished, in the manner shown at 28^g, Sheet II. The wheel, M, has about ten times the number of teeth of the pinion N.

The construction of the chucks, 28, is shown in Fig. 4, Sheet V. A hole in the end of the axis, 28, receives a die, 29. The die, 29, is of a cylindrical form at its front end for about one third of its length and is

semicylindrical throughout its remaining portion. It has a hole commencing with a bevel countersink in its center, at its front extremity, which hole extends backward along the center or axis of said cylindrical portion of said die till it opens into a semicircular groove, which is formed along the center of the flat face of the semicylindrical portion of said die throughout its whole length. A mortise is cut through the axis, 28, close behind the interior extremity of the die 29, and a notch is extended forward from said mortise on one side of said axis so far as to reach the cylindrical portion of said die. The nipper, 30, 30^a, is jointed to the axis, 28, through the aforesaid mortise by a center pin 31. The nipper, 30, fits into the aforesaid notch, anterior to the mortises of said axis, 28, so as to admit of its being closed against the flat surface of the semicylindrical portion of said die, 29. The arm, 30^a of said nipper extends obliquely backward and has at its extremity a gage screw, 32, which screw points toward the body of the axis 28. A tube, 33, which has a conical part, 33, directed forward and at its posterior extremity a circular flange, 33^a, is fitted on the axis, 28, so as to admit of said tube sliding freely forward and backward on said axis, 28, as shown in Figs. 4 and 5, Sheet V. Back of said tube, 33, on the axis, 28, is the collar 35, which is fastened on said axis by a binding screw, and an open spiral spring, 34, is placed upon the axis, 28, between said collar 35 and the tube 33. During the operation of the machine the spring, 34, will crowd the tube, 33, forward under the point of the gage screw 32, in the arm of the nipper 30, and close the nipper, 30, toward the flat face of the die, 29, as shown in Fig. 4, Sheet V, at all times, excepting when said tube is retracted or held back, in the manner hereinafter described, as shown in Fig. 5, Sheet V.

For the purpose of retracting the tube, 33, so as to allow the chucks to open to receive the wire and after the point is formed to allow the pointed shank (or pin) to be taken out of the chucks, there are two vertical plates 36^a and 36^b placed at such a level as just to allow the neck or body of said tubes, 33, to pass over them, but to intercept the flange 33^a of said tubes and crowd them back on the axis, 28, as the table D moves around, as will be understood by reference to Fig. 5, Sheet V. The arrow on said Fig. 5 indicates the direction in which the table D, may be supposed to have moved in bringing the chuck, 28, to the position in which it is shown in said Fig. 5, and the dotted curve line in which the arrow is made is an arc of a circle in which it may be supposed the front face of the flange, 33, would have revolved around the center, C, along with the table D, had said flange not been intercepted by the plate, 36, at the point where said curve line crosses said plate, 36, but said flange 33^a, coming in contact with the plate 36, at the aforesaid point of intersection, said flange 33^a would move in a straight line along the inclined plane presented by the face of said plate, 36, so that when the chuck, 28, should have arrived at the end of its supposed movement in the position shown in said Fig. 5 the tube, 33, would have been retracted and would be held back by the plate, 36, in the manner above explained, and as is shown in said figure. The positions occupied in the machine by said plates 36^a and 36^b are shown in the plan Sheet II. Each of them is fastened by screws to the front of a small stand, which stands are supported on the brackets A^{10} and A^{11}, as shown in said Sheet II.

Each of the chucks, 28, in passing from the position in which it receives the pin to that which it occupies when the pin is taken from it takes six steps with the table, D, and remains stationary, but holding and revolving with the pin in the manner before described, during five of the aforesaid periods of rest of the table D, as may be understood by reference to the plan Sheet II, in which the chuck, 28^a, as shown in said plan, is in the position for receiving the pin and the chuck 28^g is in the position for having the pin removed from it, and the chuck 28^a in passing around to the position occupied by, 28^g, by steps with the table D, would occupy successively the position occupied by each of the intermediate chucks (28 *b* to *f*), as represented on said plan Sheet II.

Of the circular revolving files or grinders and the combination by which their movements are produced.—The construction of the machine herein described is such that each pin made by it might be submitted to one operation for forming its point at each one of the aforesaid five positions in which it is held and turned around by the pointing chuck, in the manner hereinbefore described, in case a mill or suitable apparatus such as is herein described were provided and put in operation, so as to act properly upon the point of the pin at each of the aforesaid positions. But the machine as represented in Sheet II has three such mills for grinding and sharpening the points of the pins, marked in said drawing 38^a, 38^b, and 38^c, and each pin made by such machine will receive successively the operation of each one of said mills in the formation of its point. The combination for actuating the mills, 38, is the same in principle for each of them; but the action of said combination in governing the operation of the revolving grinder on the pin in forming and polishing its point may be modified by

varying the adjustment of different parts of said combination or by varying the form and proportions of some of the parts of the same, as is in some measure explained in this description, and as observation and experience will direct the skilful operator. The general description herein contained may be considered as equally applicable to each of the three mills or grinding apparatus employed in the machine, as represented in Sheet II, and the number or reference 38, which is marked on the several circular files, as shown in said plan, is frequently employed in this description to designate the whole or some part of the combination by which said files are actuated, always however including one of said files as a member of said combination. I employ the term mill herein in some instances in a general sense to indicate the whole or some part of the aforesaid combination, but always inclusive of the circular file or grinder, 38, and in other instances I employ said term in a restricted sense, to indicate said file or grinder only, or the grinding surface thereof, as may be understood by the connection in which said term is used. Although I employ, in the machine herein described, circular files for grinding and sharpening the points of the pins, yet cylinders coated with emery, or stones of suitable form and texture, or straps coated with emery or other grinding or polishing material and caused to run over pulleys might be substituted for said files (in case any such substitute should be considered desirable) without varying the principle according to which the particular kind of grinding surface employed is made to operate in grinding and forming said points. The mill 38, has a continued rotary movement around its axis, a reciprocating movement in the plane of its rotation, and a reciprocating movement in the direction of the length of its axis.

The combination for adjusting the mill, 38, and for producing its movements is represented in Fig. 2, Sheet III, and Figs. 1 and 2, Sheet V. The circular file, 38, is a cylinder or ring of steel, which has teeth cut in the manner of a float or file around the whole of its circumference and being properly tempered. Said file, 38, is fitted on an axis or spindle 40, by means of two flanges of brass 39 (*a* and *b*) in the manner shown in Fig. 1, Sheet V. The flange 39^a is permanently fitted against a collar on the axis, 40, and the flange, 39^b, is fitted to said axis so as to shift off and on. Each of the flanges, 39, has a lateral rim fitted to the interior diameter of the ring or file, 38, said ring is placed between said flanges on the axis 40, having their respective lateral rims fitted into it, and a nut, 41, is screwed on the axis, 40, against the flange, 39^b, in the manner shown in the section Fig. 1, Sheet V.

On the arbor or axis 40, there is a grooved pulley, 43, which is connected by a band, 44, with the driving pulley, 45, on the shaft L, for the purpose of communicating the rotary motion of the mill. As the axis, 40, are not in each case parallel with the axis L, guide pulleys must be suitably placed to guide the band, 44, between the aforesaid pulleys, 43 and 45. There is a grooved collar, 46, fitted and fastened by a binding screw on the axis, 40, the groove of which is fitted to the guide, 47, so that when the mill is moved forward or backward in a direction parallel to its axis the guide 47 acting by the collar 46, communicates to said mill a lateral motion in the direction of the length of its axis 40, to the right or left, by means of which lateral movement of the mill the portion of its grinding surface brought into action at any one operation in the formation of the point of the pin is progressively changed so as to prevent the unequal wearing of said surface.

The combination of the collar, 46, with the guide, 47, is shown in Fig. 1, Sheet V. The axis, 40, of the mill lies in a horizontal position on the ways 48^a and 48^b and is held between the prongs of two forks formed at the extremities of the arms of the lever *j*. The thimbles or boxes, 49, Fig. 1, Sheet V, are put upon the arbor, 40, to relieve the friction produced in running the mill at a high speed. The lever, *j*, is jointed by a center pin or stud, 50, to the lower end of a fixed support or stand A^9, which stand A^9, is fixed by a screw-bolt, 51, in a depending position to the under side of the portion A^4 of the fixed frame, as shown in Fig. 2, Sheet III. The mill stand A^9 has two arms, the extremities of which are turned forward to receive the adjusting screws, 59^a and 59^b, as shown in said Fig. 2, Sheet III. The ways or tracks, 48^a and 48^b are formed upon the upper edges of two prongs of a forked piece 48, which has the two prongs 48^a and 48^b and the cylindrical shank 48^c. The shank 48^c is fitted into a tube or socket in the upper horizontal portion of a piece 52, and is connected with said piece 52, by the bent plate, 54, and the thumb-screw, 55, and the collar 53, as shown in the last named figure. The plate, 54, is screwed fast on the back part of the tube 52, and has its outer extremity bent round so as to be in a transverse position behind the end of the shank, 48^c, as is shown in the last named figure and in Sheet II. A thumbscrew, 55, is screwed into the back end of the shank 48^c, and has a neck which is fitted into a slot or fork in said transverse portion of the plate, 54. The collar, 53, fits and is fastened by a binding screw on the shank 48^c, and the side of said collar 53, next the plate, 54, is flatted by a flat surface against said plate so as to prevent said collar or the forked piece (on the shank, 48^c, of which said collar is fastened) from turn-

ing. If the thumbscrew, 55, be turned out it will thrust the ways, 48^a and 48^b forward, and if said screw be turned in it will draw said ways back, and if the binding screw 53, be loosened the forked piece may be turned one way or the other around the axis of its shank 48^c, and fixed in any required position by fastening said collar. The tube, 52, has a vertical plate, 52^a extending downward parallel with the stand, A^9, and at the bottom of said plate, 52^a, a horizontal portion, 52^b, projects forward at right angles to the face of said stand A^9. Between the plate, 52^a, and the face of the stand, A^9, is a plate, 58, which extends downward along the face of said stand, a little below the bottom of said plate, 52^a, and has at its bottom a horizontal portion 58^a, projecting forward under the projection 52^b. The piece, 58, is attached to the stand A^9 by a single screw which passes through a hole in said stand and is screwed into the plate 58 at its upper end and near the top of said stand. The last named screw serves as a fixed stud or center around which the plate, 58, may be moved in being adjusted by the adjusting screws 59^9, and 59^b, the points of which screws bear against the sides of said plate near its bottom.

The plate, 52^a, of the tube 52, is connected with the plate 58 (so as to allow said plate 52^a to adjust up or down along the face of the plate 58) by a binding screw, 56, which passes through a vertical slot in the plate, 52^a, and is screwed into the plate 58, and by an adjusting screw, 57, which is screwed into the horizontal projection 52^b, at the bottom of the plate 52^a, and is fitted by its neck into a slot or fork in the horizontal projection, 58^a, at the bottom of the plate 58. If the adjusting screw, 57, be turned out it will move the piece, 52, together with the forked piece 48 and the mill, 38, resting on the ways 48^a and 48^b, directly upward, and if said screw, 57, be turned in it will move said parts downward. If the adjusting screws 59^a and 59^b be turned so as to move the foot of the piece, 58, back in the direction of the screw 59^b, the ways 48^a and 48^b will be tilted downward and will have their inclination to a horizontal plane increased. If said screws be turned so as to move the foot of said piece 58 inward said ways will be tilted upward and their inclination to a horizontal plane will be diminished. An advancing and receding movement of the mill, 38, along the ways, 48^a, and 48^b is produced by the action of a cam k, and a spring 60, by means of the combination shown in Fig. 2, Sheet III, the parts of which combination are severally marked in said figure with the following letters and numbers, viz: k, l, 60, 61, 62, 63, 64, 65, j, A^9, 50, 40, 38. The cam k has its acting faces formed around its periphery. The form of said cam is shown in Fig. 3, Sheet V. The direction in which it revolves is shown by the arrow. Its advancing face, k, k', extends around one fourth of its circumference, and its receding face k', k^2, k extends around three fourths of its circumference. The dotted lines k k, and k k k, represent modifications of the form of said cam adapted to variations in the form or extent of the ways, 48, as is hereinafter explained. The cam, k, acts against the stud, 61, which stud is affixed to the upper side of the yoke, l, as shown in said Fig. 2, Sheet III. But in machines which I have constructed on the principles of the machine herein described said stud is affixed to the under side of said yoke, l, and the cam k is placed beneath the yoke l, on the axis, C, and serves as a support for the fork at the end of said yoke to rest and slide on. The yoke l is composed of two parts one of which is marked l, l', and the other is marked l^2 in the figure. The part l, l' of said yoke has its horizontal portion, l', and its vertical portion l. The horizontal portion l' of said lever has a fork at its extremity, with a space between the prongs thereof, of a breadth equal to the diameter of the shaft, C, said shaft being received into said space. The vertical portion l, extends upward from the portion l', and has its vertical face, l, directed outward from the shaft C. Said portion l, has a slot extending downward from its end along the middle of it. The part l^2 has a foot at its inner end by which it is connected to the part, l, by a binding screw which passes through the slot in said part l, and is screwed into said foot. Said screw may be shifted up or down along said slot so as to increase or diminish in a vertical direction the distance between the parts l' and l^2 of said yoke. The yoke l, is composed of two parts, in the manner above described, in order to adapt the level of the vertical portion l of said yoke to the position of the cam k on the axis C, without changing the elevation of the part, l^2, of said yoke or throwing either of the parts, l', or l^2, out of its horizontal position. The part l^2 is in a vertical position, as respects its breadth, and extends horizontally from its connection with the portion, l, to the stand A^9, and it is connected to said stand, A^9, by a stud screw, 64, which passes through a slot in the end of said yoke and is screwed into said stand. The fork of said yoke, l, by which it is connected with the shaft C, and the slot by which it is connected with the stand, A^9, are so fitted as to allow said yoke to slide endwise forward and backward, being supported and guided at each of its ends by the aforesaid connections.

There is an adjusting stud, 62, screwed on the side of the portion, l^2, of the yoke l, near

its foot, in which are two adjusting screws 62^a and 62^b, the points of which screws bear against said foot. A link 63 connects the yoke *l*, with the lever *j*, by having one end of said link jointed to the top of the stud 62, and by having the other end of said link jointed to the lever *j* by means of a stud 65, which is fitted to adjust up or down in a slot in said lever. The lever, *j*, holds the axis, 40, of the mill, in the forks at the ends of its arms so as to allow said axis to rest on the ways 48 and to follow the track of said ways in making its advancing and receding movements. The extent of the last named movements of the mill 38, may be diminished by shifting the stud 65, farther up in the slot of the lever *j*, or it may be increased by shifting said stud 65 lower down in said slot. If the adjusting screws of the stud, 62, be turned so as to move the top of said stud back to a greater distance from the shaft C, the mill 38 will be moved farther from said shaft, and if said screws be turned so as to move the upper end of said stud nearer to said shaft, the mill will be brought nearer said shaft C. A spiral spring 60, is connected by one of its ends to the lever, *j*, and by its other end to the fixed frame so that when said lever is carried back by the action of the cam *k*, said spring is stretched, and when said cam recedes the reaction of said spring draws said lever forward, causing the stud, 61, to follow down the receding face of said cam *k*.

The form of the ways, 48, and the track which will be followed by the center of the axis, 40, of the mill in traversing along its bearings on said ways are shown in Fig. 2, Sheet V. The dotted line *n*, *m*, in said figure represents said central track of the axis 40. The extent of the traversing motion of the axis, 40, of the mill along the ways, 48, should be such as to carry the bearings of said axis a little past each extremity of the curved portion of said ways. That is to say, when the highest point *k'* of the cam *k*, as shown in Fig. 3, Sheet V, is at the stud 61 the axis, 40, should rest upon the horizontal straight portion of said ways a little past the upper and outer extremity (.) of the curved portion of said ways 48, so that the center of said axis should be at or near the point marked, (.)*m*, in the dotted line or track, *n*, *m*, at which time the mill, 38, would be in the space represented by the dotted circle, m^1, as shown in Fig. 2, Sheet V, and when the lowest point *k* of said cam is at the stud, 61, said axis 40, should rest upon the declivous straight portion of said ways, a little past the lower and inner extremity (:) of said curved portion of the ways, 48, so that the center of said axis should be at or near the point *n*(.), in the dotted line or track, *n*, *m*, at which time the mill 38 would be in the space represented by the dotted circle, *n'*, as shown in said Fig. 2, Sheet V. The mark (.) in the track, *n*, *m*, indicates the position of the center of the axis 40, when said axis has its bearings on the ways 48, at the outer extremity (.) of their curved portion, at which time the mill 38, will be in the space represented by the dotted circle, m^2, in said Fig. 2; and the mark (:) in said track indicates the position of the center of said axis, 40, when the bearing of said axis on the ways 48, is at the inner extremity (:) of their curved portion, at which time the mill will be in the space represented by the dotted circle n^2, Fig. 2, Sheet V. The axis, 40, makes its advancing movement along the ways, 48, from (.)*m* to *n*(.), in its central track, *n*, *m*, in the time occupied by the receding face *k'* k^2, *k*, of the cam *k*, Fig. 3, Sheet V, revolving in the direction of the arrow in passing the stud 61. The face, *k'*, k^2, *k* of the cam, *k*, which governs the aforesaid advancing movement of the axis, 40, is formed with a view to allow said axis to move quickly over the straight portions of the ways 48 at the beginning and termination of said movement, during its passage over which the mill, 38, is not in action on the point of the pin, and to cause said axis to move less quickly but with a variable velocity in passing over the curved portion of said ways, during its passage over which the action of the mill 38 in forming the point of the pin takes place.

A distinguishing principle in the combination hereinbefore described for moving the mill, 38, is that while the axis 40 of said mill is moving along the curved portion of the ways, 48, the center of said axis moves in a curve, which is an arc of a circle, having for its center a certain point, (. 38, at the circumference of said mill, as shown in Fig. 2, Sheet V, so that if the mill, 38, does not turn upon its axis while said axis is passing over said curved portion of the ways 48 the point (. 38 at the circumference of said mill will remain stationary and will be a fixed point around which all the other parts of said mill will move. Therefore, if in the operation of the machine the pin be held and turned around by the pointing chuck, 28, in the position in which the pin *r* is shown in Fig. 2, Sheet V, having its extremity, which, is to be ground and sharpened by the mill in the formation of its point, pressed against said mill at the point (. 38, the aforesaid movement of the axis 40 of the mill will take place without causing any variation in the degree of pressure with which the extremity of the pin is applied against the mill. The method by which I originally applied the principle last above explained was by mounting the mill 38, on its axis 40 in a frame supported so as to turn on two axes having their respective

centers in a continuous right line parallel to the axis, 40, which line should touch the circumference of said mill at the point at said circumference at which the extremity of the pin should be applied, and causing said frame to turn on its axis, so that said mill should move to a sufficient extent around the extremity of the pin so applied to its circumference while said mill revolved upon its axis, 40, in the operation of pointing the pin. By causing the axis, 40, to be on the straight horizontal part of the ways 48, at the time when the pin is brought by the pointing chuck into the position for receiving the action of the mill, said mill is removed out of the reach of the pin, so as to prevent its point from striking against the mill in passing to said position, and in like manner the mill is withdrawn from the pin after having finished its operation in the formation of the point by causing said axis to lie upon the declivous portion of said ways, 48, at the time when the pin is removed from said position.

The dotted lines, *k k*, and *k k k*, Fig. 3, Sheet V, represent two modifications of the cam, *k*, by using which the extent of the traversing motion of the axis 40, along the ways 48 will be reduced, and in case either of said modifications of said cam should be employed a corresponding modification of the ways 48 would be required, which would consist in diminishing the length of their curved portion, so as to allow the axis 40, to pass beyond it to the respective straight portions at either extremity of its said traversing movement. The form and proportions of the cam, *k*, and the ways 48, represented in Figs. 2 and 3, Sheet V, and hereinbefore described, are calculated to cause the mill, 38, to act throughout the whole extent of the point of the pin during the advancing movement of its axis, 40, by which action the point may be formed and finished by a single operation of one of the mills. The modifications of said parts, *k* and 48, last above referred to, are designed to cause the mills whose movements are governed by said parts, so modified, to contribute respectively toward the forming and completing the point of the pin by a partial action thereon, or an action limited to certain portions and not extending over the whole of said point.

The object of giving to the face *k'*, *k²*, *k* of the cam *k*, the particular form represented in Fig. 3, Sheet V, and to the ways, 48, the form shown in Fig. 2, Sheet V, is to regulate the advancing movement of the mill, 38, from *m* to *n*, along the central track of its axis, 40, and to graduate the pressure of the extremity of the pin against the grinding surface of said mill (by the proper adjustment of the different parts of the combination herein described for producing said movement and regulating the position of said mill), so as to cause said mill in going through with said movement, and at the same time revolving with sufficient velocity on its axis, by the action of its grinding surface upon the extremity of the pin, held and turned around against said surface by the pointing chuck, 28, in the manner herein before described, to reduce said extremity of the pin and form thereon a round, smooth, sharp point, free from angles, and slightly convex in the direction of its length, whether such point be formed by a single mill at one operation or by the successive operations of several such mills.

Of the first and second carriers.—There are two carriers employed in the machine herein described for transferring the pin in different stages of its fabrication. The first (in the order of the operation of the machine) of said carriers removes the pin from the pointing chuck, after the completion of its point, and places it between gripping dies, preparatory to the operation of upsetting a portion at its end for the formation of its head. The second of said carriers transfers the pin from the gripping dies to finishing dies, by the action of which the head of the pin is completed. Said first and second carriers are more or less fully represented in the perspective Sheet I, the plan Sheet II, in Figs. 4 and 5, Sheet III, Figs. 1, 2, and 4, Sheet IIII, and Fig. 5, Sheet V of the drawings. The part by which the first carrier holds and carries the pin is formed at the extremity of a cylindrical shank 68, as represented in section Fig. 5, Sheet V. Said part consists of a portion of the shank, 68, the nipper, 69, the center pin 70 and the die, 85, which are formed and connected together in the same manner as the similar parts, 28, 29, 30, and 31 of the pointing chuck hereinbefore described are formed and connected together. But the nipper 69, is closed by a spring affixed to the extremity of its arm, 69ª, so as to cause the point of said spring to act against the shank, 68, as shown in said Fig. 5. In this description I use the number or reference, 68, which is marked on the shank of said first carrier in the drawings in a general way to designate said carrier. The parts and combination for supporting said carrier, 68, and producing its movements, are represented in the two views Fig. 4 and Fig. 5, Sheet III, and in part in the plan Sheet II.

A bracket, 87, which is fastened by a screw to the heading frame, A², supports the stand, 65, which is connected to said bracket, 87, by a screw as shown in Sheet II, so that said stand may be adjusted and fixed in a perpendicular position. Said stand, 65, has two horizontal arms, 65ª, and 65ᵇ, in the ends of which arms are screwed the center or pivot screws, 66, as shown in Fig. 4, Sheet III. A piece in the form of a cross, 67, 67ª,

is supported between the points of the screws 66, by receiving said points in countersinks formed at the centers of its respective ends. The vertical part, 67, of said cross, is of a cylindrical form and serves as an axis to give to the carrier 68, a reciprocating rotary motion through 90° of a circle by turning on the points of the screw 66, between which it is supported. The horizontal cross portion, 67^a furnishes a tube which extends through said portion 67^a from end to end, so that the center of said tube intersects with the center of the axis, 67, at right angles. The shank, 68, of said carrier is fitted into the tube or socket 67^a so as to allow said shank to slide forward and backward in said socket in the movement of said carrier for receiving and delivering the pin. Said carrier 68 when fitted into its bearing and combined with the cross 67, 67^a, and the stand, 65, in the manner last above described and as shown in Fig. 4, Sheet III, should be so placed in the machine that the center of the shank 68 of said carrier shall be in the same horizontal plane with the centers of the axis 28, of the pointing chucks, hereinbefore described and the center of the piston, 100, hereinafter described, and that the center of its axis, 67, shall intersect with a line extending horizontally, in continuation of the center of the piston, 100, at a point where said central line of the piston, 100 would intersect at right angles with a similar line extending in continuation of the center of the axis of the pointing chuck, 28^g, in which relative positions said parts are supposed to be as represented in the plan Sheet II.

Having described the manner in which the carrier, 68, is fitted into its place in the machine so as to allow it to perform its several movements, I proceed to describe the movements of said carrier and the combination by which its said movements are produced. Once during each revolution of the axis, C, said carrier performs a reciprocating circular movement, with its axis, 67, through ninety degrees of a circle, in passing from the position in which it is shown in the plan, Sheet II, to the position in which it is shown in Fig. 1, Sheet IIII, and in returning from the latter to the former position. Said carrier remains in each of the aforesaid positions during one fourth of a rotation of the axis, C, and it occupies the time of one fourth of a revolution of said axis in passing from one to the other of said positions in either direction. The position of the carrier, 68, shown in Sheet II is that in which said carrier takes the pin from the pointing chuck, and is therefore called in this description the receiving position of said carrier. The movement of said carrier from its last named position to that shown in Sheet IIII, Fig. 1, in which movement the pin is conveyed from the pointing chuck to the gripping dies, I call herein the carrying movement of said carrier, and the last named position of said carrier, shown in Fig. 1, Sheet IIII, I call herein its delivering position. The movement of said carrier, 68, from its delivering position to its receiving position I call herein its return movement. During its continuance in its receiving position, as shown in Figs. 4 and 5, Sheet III, said carrier, 68, moves forward in its socket, 67^a, so as to receive the point of the pin held by the pointing chuck, in the manner shown in said Fig. 5, and is again retracted, drawing the pin from the pointing chuck (from the grasp of which said pin had been released in the manner hereinbefore described). Said carrier holds the pin thus withdrawn from the pointing chuck by a portion of the point of said pin being received between the nipper 69, and the groove in the die 85, said nipper being closed thereon by its spring, as shown in Fig. 5, Sheet V, so that the greater portion of said pin will project from the end of said carrier, as shown in Fig. 1, Sheet IIII. The last described movement of said carrier is called herein its receiving movement, and a similar movement made by said carrier in its aforesaid delivering position, by which movement the pin is thrust through between the gripping dies, in the manner shown in Fig. 2, Sheet IIII, (the pin being left in the grasp of said dies on the retraction of the carrier,) I call the delivering movement of said carrier. To return to the description of the combination by which the aforesaid movements of said carrier, 68, are produced, shown in Figs. 4 and 5, Sheet III, a collar, 71, is fitted and fastened by a binding screw on the shank, 68, of said carrier. A yoke, 72, has one of its ends jointed to said collar, 71, and its other end jointed to the lever 73. The lever, 73, has a fork at its upper end one prong of which is on each side of the portion, 67^a of the cross, 67, 67^a. Near its lower end said lever, 73, has an adjusting screw, 74, and at its lower end it is jointed by a center pin, 75, to the arm or stud, 76. The arm 76, is fitted and fastened on the axis, 67. A spiral spring, 77, has one end attached to the lever, 73, and its other end to the axis, 67. The cam, 78, Fig. 5, is fitted so as to turn easily on the axis, 67. Said cam, 78, has on its under side a hub by which it rests upon the arm, 76, which hub is of sufficient depth to elevate said cam to a level with the adjusting screw, 74. It has also the two inclined faces 78^a and 78^b on its periphery. The cam, 78, is jointed to the yoke, 80, by a stud screw 79. The yoke 80, Fig. 5, having one end jointed in the manner last described to the cam, 78, has at its opposite end a slot formed in the direction of its length. Said slot receives the shaft, C, and is of a breadth equal to the diameter of said shaft. Two studs 80^a and 80^b are affixed

to said yoke, at the respective ends of the aforesaid slot, at a distance from each other just sufficient to allow the cam p to revolve between them, for the purpose of receiving the action of said cam.

The cam p, on the vertical axis, C, has on its periphery the high face p^1, the two intermediate faces, p^2, and p^3, and the low face, p^4, all of which faces are concentric with the axis, C. It has also the eccentric or inclined faces which connect the aforesaid concentric faces. The two intermediate faces, p^2, and p^3, fill up each about one-fourth of the circle, and the high face, p^1, and the low face, p^4, each with the eccentric faces which connect it with the intermediate faces p^2 and p^3, fills up a fourth part of the circle. The cam p, is represented in said Fig. 5 above the yoke, 80, in order to show the action of the cam on the studs, 80^a, and 80^b. But said cam may be placed beneath said yoke, in order to furnish a bearing for said yoke to rest and slide upon, in which case said studs would require to be affixed to the under side of said yoke. Beneath the arm, 76, on the axis, 67, is fixed an arm, 81, shown in Fig. 4, sheet III. To said arm, 81, is jointed by a stud 82, one end of the yoke, 83, and the opposite end of the yoke, 83, is connected by a slot with the axis, C, as is shown in said Fig. 4, in the same manner as the yoke 80 is connected with said axis, C, as above described. The studs 83^a and 83^b are affixed to the yoke, 83, at such a distance from each other as to allow the cam q, on the axis, C, to revolve between them, for the purpose of receiving the action of said cam. The cam q on the axis, C, has on its periphery the two faces, concentric to the axis C, q^1 and q^4, and the two eccentric faces q^2 and q^3, each of which faces occupies about one-fourth of the circle. In Fig. 4, Sheet III, the cam q is represented above the yoke, 83, and the studs, 83^a and 83^b on the upper side of said yoke. But said cam may be placed beneath said yoke in order to furnish a bearing for said yoke to rest and slide upon, in which case the studs 83^a and 83^b should be affixed to the under side of said yoke.

The reciprocating circular movement of the carrier, 68, is produced by the action of the cam, q, (revolving in the direction of the arrow) on the studs 83^a and 83^b, as will be understood by an examination of Fig. 4, Sheet III. The face, q^3, of said cam by advancing against the stud, 83^a, of said yoke moves said yoke in the direction of its length from left to right, and brings the carrier 68, into its receiving position, as shown in said figure, in which position said carrier remains till the face, q^1, of said cam has passed said stud, 83^a, at which time the face, q^3, of said cam will begin to advance against the stud, 83^b, carrying the yoke from right to left and producing the carrying movement of said carrier 68, and bringing said carrier to its delivering position, in which position said carrier remains during the time occupied by the face, q^1, of said cam in passing said stud 83^b, when the face, q^3, of said stud will begin to advance against the stud, 83^a, again producing the return movement of said carrier. During the aforesaid carrying and return movements of the carrier, 68, produced as above described by the action of the cam, q, the intermediate faces, p^2 and p^3, of the cam p, will be between the studs 80^a and 80^b of the yoke, 80, and the cam 78, on the axis, 67, will be held in such a position that neither of its eccentric faces 78^a and 78^b will be in the way of the point of the gage screw, 74, on the arrival of said carrier in its respective receiving and delivering positions, but during the continuance of said carrier in its receiving position the high face, p^1, and the two eccentric faces connected therewith of the cam p will pass the stud 80^b of the yoke, 80, moving said yoke to the left from its intermediate position, by which movement of said yoke, 80, the face 78^a of the cam 78 will be drawn in behind the point of the gage screw, 74, so as to thrust said carrier forward to receive the pin, in the manner shown in Fig. 5, Sheet III, and again withdraw said face 78^a from said screw 74 and leave said carrier 68 free to be retracted by the spring 77, and when said carrier 68 is in its delivering position, the cam, p, will act upon the stud 80^a of the yoke 80, moving said yoke to the right from its intermediate position and back to said position and producing an action of the face 78^b, of the cam 78, against the gage screw 74, similar to the action of the face, 78^a, of said cam 78 last above described, by which action of the face, 78^b, of said cam, 78, the carrier 68 will be thrust forward, so as to introduce the pin between the gripping dies, as shown in Fig. 1, Sheet IIII, and will be left by the reception of said face 78^b, to be retracted by the reaction of the spring 77.

The second carrier, by which the pin is conveyed from the gripping dies to the finishing dies, is supported by a bracket, A^{10}, which is fastened to the inside of the heading frame, A^2, and furnishes a horizontal platform of the form shown in the plan Sheet II. There is a long slot formed through said platform, extending horizontally in a direction transverse to that of the piston, 100, and the heading bolt 119, as shown in said Sheet II and hereinafter described. Said carrier is fitted and fastened on a slide which consists of the oblong flat piece 90, which rests upon the upper face of the platform, A^{10}, as shown in Sheet II, and is connected with said platform through the aforesaid slot therein by a connecting piece and cap (Note. The "Connecting Piece" and "Cap" named in the text are

designated in the figure referred to (Fig. 4, Sheet IIII) by the words "Connecting Piece" and "Cap" written upon said parts respectively) in the manner represented in Fig. 4, Sheet IIII, so as to allow said slide to move freely in a reciprocating rectilinear movement in the direction of said slot, but not to move or turn in any other direction. On the top of the slide, 90, is fitted the carrier stand, 91, which consists of the bottom horizontal part by which it is connected with the slide, 90, a transverse upright portion at its end, and two lateral, vertical flanges, as is shown in Sheet II and Fig. 4, Sheet III. To the front of the transverse vertical portion of the stand, 91, is affixed the piece, 92, which is bent at a right angle, having at one end, 92^a, a broad part, by which it is fastened by a screw to the stand 91, as shown in Fig. 4, Sheet IIII. The other end, 92, consists of a plain square bar, which is in a position nearly parallel to the line of motion of the slide 90, and is in a position considerably to the right of said slide, 90, as shown in Figs. 1 and 4, Sheet IIII. The bar, 92, constitutes the lower finger of said second carrier. It partakes of the movement of the slide, 90, and has no other movement. Immediately over the finger, 92, is the upper finger 93 of said carrier, which is jointed to the carrier stand, 91, by having the axis, 93^a, (which proceeds from said finger 93, at a right angle, in a horizontal direction) fitted into holes in the lateral flanges of said stand, 91, and secured in its place therein by a collar 94, which is fitted and fastened by a binding screw on said axis between said flanges, as shown in Figs. 1 and 4, Sheet IIII, so as to allow said finger, 93, to turn upon said axis 93^a. The finger, 93, is closed upon the finger, 92, by a spiral spring, 195, one end of which spring is attached to the binding screw of the collar 94 and its other end to the screw which binds the piece 92^a to the front of the stand. 94. At the part of said fingers, 92 and 93, when the pin is held between them, the finger 93, being a little wider than, 92, has on each side a lip, which lips overlap each side of the finger, 92, in the manner shown in Figs. 1 and 4, Sheet IIII. In each of the aforesaid lips of the finger, 93, is formed a small notch in form of an inverted V. The fingers, 92 and 93, diverge a little from each other and respectively from a horizontal line, as they extend backward from the point at which they hold the pin, as shown in Fig. 1, Sheet IIII. On the slide, 90, is an arm, 95, and on the axis, 67, of the first carrier is fixed an arm, 97, which arms, 95 and 97, are connected by a link, 96, said link being jointed by its two ends to the respective ends of said arms in the manner shown in the plan Sheet II. By the aforesaid combination (95, 96, 97) between the slide, 90, and the axis, 67, the reciprocating circular motion of the axis 67 communicates a reciprocating rectilinear motion to the slide, 90, along the slot of the platform, A^{10}. The extent of said movement of the slide, 90, will depend on the length of the arm, 97, (Note. There is a slot or fork in the end of the arm 97, and said arm may be made longer or shorter by shifting the stud connecting it with the link 96 along said slot) on the axis, 67, and should be equal to the distance between the center of the gripping dies (where the second carrier receives the pin) and the central line of the finishing dies 115 and 116, which is the position in which the pin, *r*, is held by said carrier, as shown in Fig. 1, Sheet IIII, which is the delivering position of said carrier. But for the convenience of adjustment, the arm, 95, may be made so as to admit of its springing a little and the movement of the slide, 90, may be arrested at each of its terminations by an adjusting screw in the piece, A^{10}, at each end of the aforesaid slot, 134^a, Fig. 1, Sheet IIII, and 134^b, Sheet II.

The manner in which the pin, *r*, is held between the fingers 92 and 93 is shown in Figs. 1 and 4, Sheet IIII. The nicks in the lips of the finger, 93, embracing the pin *r* on each side of the finger 92, keep it steady in a horizontal position and in the direction of a line across between said fingers from one of said nicks to the other. To understand the manner in which the pin, *r*, is transferred from the carrier, 92, 93, to the receiving or female finishing die, 116, Fig. 3, Sheet IIII, and also how the pin as taken hold of by said carrier, suppose the pin to be held by said carrier in the position shown in Fig. 1, Sheet IIII. The heading bolt, 119, carrying said die, 116, in its end, as shown in Figs. 1 and 3, Sheet IIII, advances so as to bring the extremity of said die close to the side of said carrier, and that portion of the pin which projects from said carrier toward said die is received into the central hole of said die. Having arrived in the last described position said bolts stop and remain stationary, with the pin in the die as above described. While said bolt 119 remains in the last named position, said carrier commences its return movement, drawing off from the pin so held in the die, 116, by the inclination of the aforesaid nicks of said carrier rising up over the shank of the pin, and leaving the pin in said die, and when said carrier approaches its receiving position the projecting part of the pin held by the gripping dies, as shown in Fig. 3, Sheet IIII, serves as a fixed line to elevate the finger 93, by the inclination of the under side of said finger riding upon the pin, and when said carrier reaches its receiving position said finger, 93, falls down, receiving the pin into said nicks and holding it by the

action of the spring, 195, in the manner hereinbefore described. The lower finger, 92, is fixed at such an elevation as to allow it to pass close under the pin (in the last described movement) without touching or crowding it. An inclined vertical plate, 103, Fig. 3, Sheet IIII, is so placed as to crowd the pin back in the direction of its length in the carrier 92, 93, as said carrier moves from its receiving to its delivering position, so as to cause the point of the pin to project back from said carrier toward the die 116, as shown in Fig 1, Sheet IIII.

Of the combination for gaging and punching up the heads of the pins.—The heads of the pins made by the machine herein described are formed at two operations, by the first of which a portion of the wire is punched up in the direction of the length of the pin, so as to form a lump or thickening containing a sufficient quantity of metal to constitute the head of the required size. By the second operation the aforesaid lump or thickening is compressed between two dies of such shape as to mold it into a head of suitable form. The principal parts employed in the first of the aforesaid operations—viz., gaging and upsetting the heads—are the upper and lower gripping dies, 98 and 98^a, the cam, *s*, and the lever, *t*, for closing said dies, the gage 99, the piston, 100, the piston tube 101, Fig. 2, Sheet IIII, the punch tube, 102, and the punch, *u*, Fig. 3, Sheet IIII. See also the plan Sheet II. The gripping dies, 98, are of the form shown in Figs. 3 and 4, Sheet IIII, and in perspective Fig. 2, Sheet IIII. They have each a cylindrical shank or stem, 98^c, and a semicircular projection on the side next the piston tube 101, which projections form, when the dies are closed, a circular boss, the diameter of which is equal to the interior diameter of the tube 101. A semicircular groove is formed across the face of each of the dies, 98 and 98^a, extending from the center of its semicircular projection to the opposite side of the die, having each of its ends enlarged in the form shown in Figs. 3 and 4, Sheet IIII When the dies, 98, and 98^a, are closed together the aforesaid semicircular grooves in their faces form a hole extending through between said dies from the center of the boss formed by their semicircular projections to the opposite side of the dies, as is shown in section, Fig. 4, Sheet IIII. Said grooves must be of such a depth as to hold the pin firmly when the dies are forcibly closed upon it.

The dies, 98, are fitted by their cylindrical shanks, 98^c, into holes or sockets in a stand, 104, so as to allow their interior ends, on which are formed the aforesaid semicircular projections and grooves, to meet near the center of said stand, as shown in Fig. 4, Sheet III. Said stand has its main part 104, which consists of two portions, having a space between them, as shown in the vertical section, Fig. 4, Sheet IIII. The aforesaid portions of the stand 104, are united with each other on each side by an arched bridge, 104^b, and 104^c, as will be understood from an examination of the horizontal section, Fig. 3, and the vertical section, Fig. 4, Sheet IIII. To each of the aforesaid portions of the stand, 104, is fitted and fastened by screws a cap, 104^a, and the sockets to receive the shanks 98^c, of the gripping dies are formed, respectively one half in the main part of the stand 104 and the other half in the caps, 104^a, said sockets being exactly in line with each other. Said stand 104, with the dies, 98, fitted into it in the manner above explained, is fixed and adjusted in its place in the heading frame, A^2, so that the shanks 98^c, of said dies shall stand in a perpendicular position, and the hole formed by the aforesaid grooves in the face of said dies, when said dies are closed together, shall be in continuation of the central line of the piston 100, as will be understood from a view of Figs. 2, 3 and 4, Sheet IIII. Two adjusting screws screwed through each of the sides of the heading frame A^2 and bearing with their points against the sides of the stand 104, serve to adjust said stand laterally, in the manner shown at 105 and 105^a, Fig. 3, Sheet IIII. In the vertical direction the position of said dies will be determined by the adjusting screw 86, against which the shank of the upper die, 98, rests in a fixed position, as shown in Fig. 4, Sheet IIII. An arch, 106, is screwed on the top of the frame, A^2, extending from one side to the other of said frame, over the top of the stand, 104, as shown in Sheets I and II and in Figs. 2 and 4, Sheet IIII. Said arch serves to hold the adjusting stop-screw, 86, the point of which screw bears against the end of the shank of the die, 98, and sustains the pressure when the die, 98^a, is forcibly closed against said die, 98, to hold the pin in the operation of upsetting the head.

The gage, 99, has the form shown in Sheet I and Fig. 2, Sheet IIII. In front an inclined part 99^a presents a vertical face, against which the end of the pin on which the head is to be formed strikes and stops when the pin is thrust in between the gripping dies by the first carrier in the manner hereinbefore described. If the carrier, 68, continues to move forward a little farther after the pin stops against the gage, 99, the pin will be crowded farther in under the nipper of said carrier. The back end of the gage, 99, is bent down at a right angle, and is connected by a gage screw, 84, to the heading frame, A^2. Said screw 84, passes through the vertical portion of the gage 99, and is screwed into a cross portion of the frame A^2, which forms one of the bearings of the piston 100 beneath the back end of

said piston, as shown at 84, Fig. 2, Sheet IIII. There is an open spiral spring placed upon the body of the gage screw, 84, between the vertical part of said gage, 99, through which said screw passes, and the frame A^2, which serves to keep said portion of the gage 99, always pressed back against the head of said screw 84. There is a hole in said vertical portion of the gage, 99, through which the piston 100 passes, which hole is large enough to allow said gage to move upon the screw 84 as its center of motion or joint, in the manner hereinafter described, without touching said piston.

The lever, *t*, for closing the gripping die, 98^a, against the stationary die, 98, is jointed to the frame A^2, by a center pin, 107, which passes through the two vertical sides of the frame, A^2, and through the axis, t^1, of said lever *t*, see 107, Sheet I, and Fig. 2, Sheet IIII. Said lever has in its short arm, t^2, an adjusting screw, 108, which screw bears against the lower end of the shank of the die, 98^a. The long arm, *t*, of said lever extends downward in front of the cam, S, presenting a suitable face for said cam to act against in closing the die, 98^a, as shown in Fig. 2, Sheet IIII, and a prolongation of said arm, *t*, is connected by a spring 88, to the fixed frame, for the purpose of drawing said arm toward the cam, S, and retracting it as the cam recedes, Fig. 2, Sheet IIII, and the short arm, t^2, of said lever is yoked to the lower end of the shank of said die, 98^a, as shown in Fig. 2, Sheet IIII, so that when said arm, t^2, is retracted it draws down said die, 98^a, and separates it from the stationary die, 98, leaving a space for the fin, *r*, to be carried out laterally, by the second carrier, from between said dies to the position in which it is shown in Fig. 1, Sheet IIII. The cam, S, is fixed upon the axis B with which it revolves in the direction shown by the arrow, as represented in Fig. 2, Sheet IIII. The acting faces of the cam, S, are formed on its circumference parallel to its axis. It has the low face or recess, S, the intermediate face, S^1, and the high face, S^2, each of which faces is concentric with the axis B. When the low face, S, of said cam is passing the face of the lever, *t*, against which said cam acts, said lever will be in a retracted position, and the dies will remain separated. When the face, S^1, of said cam is passing said face of the lever, *t*, the die, 98^a, will be forced up so as to be nearly in contact with the die, 98, but leaving space enough between said dies for the pin to be thrust in lengthwise between the aforesaid grooves on the faces of said dies. When the high face, S^2, of said cam is passing said face of the lever *t*, the die, 98^a, will be firmly pressed against the stationary die, 98, so as to embrace the pin which has been introduced between said dies, in the grooves upon their faces, with sufficient force to allow the punch, *u*, advancing against the end of the pin, in the manner hereinafter described, to upset a portion of it to form the head.

The piston 100 and the piston tube, 101, are fitted together and into bearings formed in cross-pieces which connect the two vertical sides of the heading frame, A^2, in the manner shown in Figs. 2 and 3, Sheet IIII. The tube, 101, is fitted to slide endwise in its bearing in the frame A^2 and on the small end of the piston, 100, and the piston, 100, is fitted to slide endwise in its bearings in the frame, A^2. The punch tube, 102, is firmly fixed in the piston tube, 101, near the front end of said piston tube. The hole in the punch tube, 102, corresponds in size with the punch, *u*, and is a little larger than the wire of which the pins are made. The punch, *u*, has its back end resting in a socket in the end of the piston, 100, and the front end of said punch rests in the punch tube, 102, as is shown in Fig. 3, Sheet IIII. There is a collar, III, Fig. 3, Sheet IIII, fitted and fastened by a binding screw on the piston, 100, and between said collar, 111, and the back end of the piston tube, 101, there is an open spiral spring, 109, which spring crowds said tube forward on said piston as far as the yoke, 110, which connects the tube, 101, with the piston, 100, as shown in Fig. 2, Sheet IIII, will allow said tube to go. There is a slot in the end of the yoke, 110, through which a stud screw is screwed into the collar, 111, or into the piston, 100, to connect said piston and yoke together. The object of the aforesaid slot in the yoke, 110, is to allow the piston, carrying the punch, *u*, in its end, to continue to move forward after the tube 101 is stopped by the punch tube, 102, fast in the end of said tube, 101, coming against the face of the boss on the united dies, 98 and 98^a, as shown in Fig. 3, Sheet IIII. The pin, *r*, being firmly held by the gripping dies, 98 and 98^a, and the piston, 100, piston tube, 101, punch tube, 102, and the punch, *u*, having, respectively, by moving forward altogether, reached the position in which they are represented in Fig. 3, Sheet IIII, the punch tube, 102, will stop against the face of the aforesaid boss of the united dies, 98 and 98^a. but the piston 100 with the punch *u*, will continue to move forward, and the punch, *u*, will push that portion of the pin *r* which is in the punch tube 102, before it, as said punch advances, crowding said portion of the pin out of the punch tube 102, and pressing it into the center sink formed by the junction of said dies 98, in the center of their aforesaid circular boss. At the same time the collar, 111, will compress the spring, 109, against the back end of the tube, 101, so as to keep the punch tube 102 applied firmly against the face of the aforesaid boss of the dies, 98.

The piston 100 receives a reciprocating movement in the direction of its length, from the circular eccentric, *w*, Fig. 2, Sheet IIII. Said eccentric, *w*, is fixed on the axis, B, with which it revolves in the direction of the arrow, between the prongs, x^1 and x^2 of the forked lever *x*. The lever *x* is jointed to the heading frame, A^2, by a center pin, 112, as shown in Sheets I and II and Fig. 2, Sheet IIII. The single arm, x^3, of the lever, *x*, extends obliquely upward behind the back end of the piston, 100. The yoke, 113, connects the extremity of said arm, x^3, with the end of the piston, 100, as is shown in Fig. 2, Sheet IIII. A gage screw, 114, is fixed in the end of the arm x^3, behind the end of the piston, 100, as is shown in Fig. 2, Sheet IIII, which screw serves to communicate the pressure of the lever, *x*, to the piston, 100, in punching up the head of the pin and to graduate that pressure. When the piston, 100, with the tube 101 at its end, advances from its retracted position shown in Fig. 2, Sheet IIII, to the position in which it is shown in Fig. 3, Sheet IIII, the end of the tube 101 strikes against the inclined part of the gage 99, and crowds said gage upward, causing it to rise over the top of the advancing tube, and when said piston and tube recede said gage falls down again to its place as shown in Fig. 2, Sheet IIII.

Of the finishing dies and the parts accessory to their operation.—There is an opening in the vertical part, which forms the outer side of the heading frame, A^2, which leaves a clear passage for the conveyance of the pin, by the second carrier, from the gripping dies to the position in which it is represented as being held by said carrier in Fig. 1, Sheet IIII. The finishing dies are fitted into sockets in the ends of bolts, which bolts are fitted into bearings in a separate frame piece, A^3. The frame piece, A^3, is fastened by screws upon the outer side of the heading frame, A^2, and has an opening through it, corresponding with the opening above described in the side of the heading frame A^2, for the conveyance of the pin by the second arm. The dies, in connection with their respective bolts, are represented in the horizontal section Fig. 3, Sheet IIII. The crown die 115 has a small concavity in its front end, which serves as a matrix to form the top of the head of the pin. There is a similar concavity in the end of the female die 116, which is the matrix to form the under side of the head, and a hole through the center of said die to receive the shank of the pin. In compressing the head of the pin between said dies the pressure is applied in the direction of the length of the pin in the manner shown in Fig. 3, Sheet IIII. The crown die 115 is fitted into a socket in the front end of the short stationary bolt, 117. The bolt 117 has a single bearing in the frame piece, A^3, and has its back end resting against the gage screw 118, which screw 118 is screwed through a strong projection on the side of the heading frame, A^2, and serves to graduate and sustain the pressure in compressing the head of the pin. The inferior or female die, 116, is fitted into a socket in the end of the long sliding bolt, 119. The bolt, 119, is fitted to slide in two bearings in the frame piece, A^3. The sockets or bearings for the bolts 117 and 119, are in line with each other. The bolt, 119, is connected at its back end to the short arm of the lever 120, by a yoke 121, as shown in Sheet I. A gage screw 122 in the end of the short arm of the lever 120, bears against the back end of the bolt 119, and serves to communicate the pressure of said lever to said bolt, in compressing the head of the pin and to graduate that pressure. The lever 120, shown in Sheet I, is jointed by a center pin or stud 123, to the outside of the heading frame, A^2. It has the short arm, 120, extending obliquely upward, by which it is connected with the bolt, 119, by the yoke, 121, and it has the long arm, 120^a, which extends obliquely forward and downward under the cam, *y*, presenting a face on its upper surface, at its end, for said cam to act against. There is a spring, 124, attached to the end of said arm, 120^a, by one end and having its other end connected with the fixed frame, so as to retract said arm, 120^a, as the cam, *y*, recedes after having acted in pressing said arm down.

The cam, *y*, is fixed on the axis B, so as to revolve with said axis in the direction of the arrow, between the bearing of said axis B in the frame, A^1, and the outside of the heading frame, A^2, as shown in Sheet, I. The acting faces of the cam, *y*, are formed upon its circumference, parallel to its axis. It has the rising face, *y*, the intermediate face, y^1, which is concentric with the axis, B, the rising face y^2, and the receding face, y^3, note, while the low part of the cam, *y*, between its faces y^3, and, *y*, is passing the lever 120, and the bolt, 119, is consequently retracted to the position in which said bolt is shown in Fig. 1, Sheet IIII, the pin is brought by the second carrier into the position in which it is shown in said Fig. 1, Sheet IIII, and held there in readiness to be received in the die 116, and while the pin is held by said carrier in the aforesaid situation the face, *y*, of said cam will pass the lever 120 and the concentric face, y^1, of said cam will begin its passage over the face of said lever. By the action of the eccentric face, *y*, of said cam the bolt 119, will be carried forward so far as to bring the extremity of the die, 116, close to the side of said carrier and the projecting portion of the pin will be received into the central hole of said die. The bolt, 119, will remain stationary in the last de-

scribed position while said concentric face, y^1, of the cam is passing the lever, 120, and during that time the carrier will be withdrawn, leasing the pin in the die, 116, as above described, with its unfinished head resting against the crown die 115. When the eccentric face, y^2, of said cam reaches the lever, 120, the bolt 119, will again advance, and when the highest part of said cam passes said lever the die, 116, will be pressed against the die 115 and the head of the pin will be compressed between said dies, as is shown in Fig. 3, Sheet IIII. In the front end of the bolt, 119, immediately back of the die, 116, a slot or mortise is cut through said bolt, as is shown in Fig. 3, Sheet IIII. There is a slide Z fitted into the aforesaid mortise of the bolt, 119, having a tapering hole commencing with a countersink formed in it to receive the point of the pin, r, projecting through the hole in the die, 116, in the manner shown in Fig. 3, Sheet IIII, for the purpose of pushing the pin out of said die as the bolt, 119, recedes after the compression of the head of the pin between the dies 115 and 116. A sliding yoke, 125, consisting of a plate of metal having a portion at each of its ends bent at right angles and having a hole in each of its bent ends for the bolt, 119, to pass through, is placed upon said bolt, 119, as is shown in Sheets I. and II. and partially in Figs. 1 and 3, Sheet IIII. In front, said yoke, 125, is applied against the back part of the slide Z, or against a ring, 135, which may be interposed between said yoke and slide, as shown in Fig. 1, Sheet IIII. At the back end of said bolt, 119, there is an open spiral spring, 126, placed on said bolt behind the yoke, 125, and between said yoke and a collar, 136, which is fastened on said bolt, as shown in Sheet II., which spring 126, crowds said yoke forward against the slide, Z.

Underneath the sliding yoke, 125, is a lever 127, which is jointed by a stud screw to the side of the frame, A^3. The front end of said lever, 127, is in the form of a catch or angular point, fitted to catch into a notch in the lower edge of the yoke, 125, as represented in sheet I. and Fig. 1, Sheet IIII, and at the back end of said lever is an inclined portion, beneath which is a stud, 128, affixed to the side of the short arm of the lever, 120, so as to stand out in a horizontal direction transversely to said inclined part of the lever, 127. A spring 129 connecting the back end of said lever 129, with the fixed frame, draws that end of said lever down toward the aforesaid stud, 128, as is shown in Sheet I. When the bolt, 119, moves forward for the purpose of receiving the pin into the die, 116, and compressing the head of the pin in the manner herein before described, the yoke, 125, will be carried forward with said bolt so far as to bring the notch in the lower edge of said yoke a little forward of the point of said lever, 127, and the stud 128 will have the inclined part of said lever, so as to allow the spring, 129, to draw down the back end of said lever and tilt its point up against the lower edge of said yoke. But the point of the pin, r, will enter the hole in the slide, Z, and arrest the advance of said slide and the yoke, 125, before the forward movement of the bolt, 119, is completed, as will be understood by a reference to Fig. 3, Sheet IIII.

When the bolt, 119, recedes after the compression of the head of the pin (if the pin sticks in the die, 116, so as to prevent its being crowded out of said die by the action of the spring, 126, against the back end of the yoke 125) the yoke, 125, will move back with said bolt till the notch in its lower edge arrives at the point of the lever, 127, and said point will rise up into said notch (by the action of the spring, 129) and arrest the receding movement of said yoke while said bolt continues to move back, by which means the pin will be partially crowded out of said die, when the head of the pin will be caught in the fork of the claw, 130, in the manner hereinafter described, and drawn out of the receding die. After the pin is started out of the die 116, in the manner above described, and before said die reaches the slide, Z, the stud, 128, will elevate the back end of the lever, 127, by coming against the inclined part thereof, so as to withdraw the point of said lever from the notch of the yoke, 125, and leave said yoke and the slide, Z, free to move back with the bolt, 119.

The claw or fork, 130, is shown in Figs. 1 and 3, Sheet IIII. It presents an inclined face toward the front end of the bolt, 119, and has the space between its two prongs of sufficient breadth to receive the body of the pin, but too narrow to allow the head of the pin to pass through it. Said claw is connected to the lever, 131, through a slot in said lever (to allow said claw to be adjusted up or down) by a screw and nut in the manner shown in Fig. 3, Sheet IIII. The lever, 131, is jointed to a brace, A^{12}, of the fixed frame by the stud, 132, and is drawn toward the bolt, 119, by a spiral spring, 133, as shown in Fig. 1, Sheet IIII. There is a screw, 137, Fig. 1, Sheet IIII, fitted in the top of the lever, 131, (Note.—A portion of the lever 131, as shown in Fig. 1, Sheet IIII, is represented as broken away, in order to show subjacent parts, and the screw 137 is shown in the upper detached portion of said lever) the point of which screw strikes against the heading frame, A^2, and stops said lever when it is drawn in by the spring 133. When the second carrier brings the pin into the position shown in Fig. 1, Sheet IIII, the ends of the fingers of said carrier strike against the claw, 130, and crowd it back, as

in Fig. 1, Sheet IIII, but when said carrier returns the inclined face of said claw will lodge against the end of the bolt, 119, and as said bolt advances it will crowd said claw out of the way by acting against its inclined face, removing it to the position shown in Fig. 3, Sheet IIII. On the retraction of the bolt 119, after the completion of the head of the pin, and the partial expulsion of the pin from the die, 116, in the manner before described, the claw 130, will be drawn forward close in front of the receding bolt, 119, by its spring, 133, so as to receive the body of the pin, *r*, in the fork of said claw, and catching the pin by its head, will arrest and hold it, while the bolt, 119, continuing to recede will draw the die, 116, off from the pin, and then the pin will fall from the said claw completely formed, ready to undergo the process of tinning or whitening.

Of the general combination, adjustment, and operation of the machine.—The adjustment of the different parts of the machine, as respects their position, the period and extent of their movements and their several actions in holding, carrying and acting upon the pin, having been particularly explained in the foregoing description, I consider it unnecessary to recapitulate such explanation further than as relates to the general structure and management of the machine. In this general description I shall refer to the individual parts and minor combinations of the machine by the names or marks of reference by which they have been designated in the description hereinbefore given, without referring to the particular figures of the drawings in which they are respectively represented.

The main axis, B, which carries the several cams for feeding in and cutting off the wire, for closing the gripping dies, for upsetting the head of the pin, and for compressing the head between the finishing dies, is placed in a horizontal position, and each of said cams must be adjusted and fixed upon said axis in such a situation as to allow it to act properly upon the lever or other part designed to receive and transmit its action, and so as to produce said action at the proper period, relatively to other actions of the machine to which it may be particularly related or with which it may immediately coöperate. The foregoing observations are equally applicable to the several cams which are fixed upon the vertical axis, C, viz., the cam for producing the movement of the table, D, the several cams for producing the reciprocating movements of the mills, and the two cams for actuating the carriers. The position of the vertical axis, C, in reference to the axis, B, to the circular horizontal portion of the frame, A^4, and to other parts of the machine may be understood by a reference to the plan of the machine, Sheet II.

The pin is conveyed from one position to another and is acted upon in the different stages of its formation by the machine in one horizontal plane—about nine inches above the center of the axis B, and about one inch above the upper surface of the horizontal position A^4, of the fixed frame. The action of the several mills in grinding the points of the pins will vary in proportion as said mills or files are more or less sharp, and will also be influenced by the bending or springing of the pin, when pressed against said files, according as the wire is more or less stiff, and great nicety (which can only be attained by careful trial) is required in adjusting, and managing said mills, in reference to the aforesaid causes of variation, in their action upon the point of the pin. Whenever the acting portion of the mill becomes too dull or smooth to act with advantage, a new portion of said mill may be brought into action by shifting the grooved collar, 46, on the axis of the mill, and by shifting said collar from time to time the whole surface of the mill, in successive portions may be brought into action. The speed at which I usually run the mills is such as to give to their circumference a velocity of from four to five thousand feet per minute. The adjusting screws, against the points of which the conical tubes 33 act in closing the nippers of the pointing chucks, should be so set that each of said nippers, when the tube which closes it is retracted, in the manner explained in the foregoing description, will open sufficiently to receive the wire or to allow the pin to be withdrawn from it. The first carrier must be adjusted so as to take the pin from the pointing chuck and introduce it between the gripping dies without bending it, and the strength of the spring by which the nipper of said carrier is closed must be such as to enable said carrier to hold the pin with considerable firmness, but not with so much force as to prevent said carrier from being retracted by its spring and drawn off from the pin after the gripping dies have closed upon it. The second carrier must be adjusted so as to receive the pin fairly, and hold it when said carrier is in its delivering position, so that the point of the pin will enter the receiving die, 116, while the head of the pin is fairly presented toward the matrix of the crown die. The gaging of the metal for the head of the pin, the force of the closure of the gripping dies and the pressure in punching up the head of the pin and compressing it between the finishing dies must be ascertained by trial and regulated by the appropriate adjusting screws.

In a general description of the operation

of the machine, it will be convenient to consider the operations of feeding in and cutting off the wire, the simultaneous operations of the several mills upon the points of the pins, and the operation of the first carrier intaking the pin from the pointing chuck, and all the movements of the several parts by which the aforesaid operations are performed and repeated at each successive revolution of the main axis, B, in reference to the periods of motion and rest of the revolving table, D. The periods of the partial and complete closure of the gripping dies have reference to the delivering movement of the first carrier; the period of the opening or separation of said dies has reference to the carrying movement of the second carrier. The timing of the movement of the piston, 100, for punching up the head of the pin corresponds with the complete closure of the gripping dies, and the movements of the heading bolt, 119, which carries the receiving die, 116, are timed in reference to the return movement of the second carrier.

The wire for one pin is introduced and one completely formed pin is dropped from the machine at each revolution of the principal axes B and C; but each pin made by the machine requires eight revolutions of said axes to carry it through the successive stages of its formation, from the time of the introduction of the wire till the pin is discharged from the machine. The period of rest of the table, D, comprises three fourths and its movement one fourth of the time of one revolution of the axis, B. When said table is at rest during the regular operation of the machine, one of the pointing chucks will be in a situation to receive the wire from the feeder and one in a position to have the pin, which has had its point completed, taken from it by the first carrier, and each of these will have the wedge or conical tube, by which its nipper is closed in holding the pin, retracted, so as to allow the wire to be introduced into the former and the pointed shank or pin to be taken from the latter. Five of the pointing chucks will be holding and turning around with pins, and three of the pins so held and turned will go through with one of the three operations by which the points are formed, (or in case five revolving files or other apparatus for grinding and forming the points be used, which the construction of the machine allows, each of the aforesaid five pins will go through with one of the five operations for forming its point.) During each period of rest of the table D, the apparatus for feeding in and cutting of the wire go through with their combined movements for introducing and cutting off the wire for a pin, in the following order: The feeder advances, carrying forward the wire, and before the feeder relaxes its grasp on the wire or begins to recede the cutter closes so as to bite and hold the wire. The feeder then relaxes its grasp on the wire, recedes and again renews its grasp on the wire, preparatory to the introduction of another succeeding portion of wire, before the cutter acts to cut off the portion which had been last introduced, and then just as the table, D, is about to commence its movement the cutter suddenly moves forward to cut off the wire and is immediately retracted. The table then completes its movement, bringing another of the pointing chucks into the position for receiving the wire, and during the time of the movement of the table D both the cutter and the feeder remain at rest in their retracted positions, the feeder continuing to hold onto the wire and both of said parts being in readiness to repeat the movements and operations above described during the next succeeding period of rest of the table D. At the commencement of the movement of the table D, the flange of the retracted conical tube of the pointing chuck, which had received the wire during the preceding period of rest of said table, leaves the vertical plate by which it had been retracted and said tube is thrust forward by its spring so as to close the nipper upon the end of the wire which had been introduced into said chuck. During the period of rest of the table D, all the mills simultaneously move forward and perform their several operations in forming the points of the pins, and simultaneously with the movement of said table all the mills recede to their respective retracted positions, preparatory to the repetition of their aforesaid advancing movements and operations upon the points of the pins during the next succeeding period of rest of the table D.

The first and second carriers reach their receiving positions about the time when the table, D, completes its movement. The first carrier takes the pin from the chuck which has arrived in the position to have the pin which has had its point completed withdrawn from it, and while the aforesaid operation is being performed by the first carrier the gripping dies will separate, leaving the pin which has received the action of the punch for upsetting or punching up a head on it in the grasp of the second carrier, the lower die being retracted so far as to give room for said carrier to carry said pin out sidewise from between said dies, and then said carriers, each bearing its pin, simultaneously perform their carrying movements and reach their respective delivering positions. Before the first carrier moves forward to introduce the pin between the gripping dies said dies will be partially closed, and then said carrier moves forward, intro-

ducing the pin between said dies and thrusting the end of the pin against the gage, which regulates the quantity of metal to be upset for the head of the pin. Before said carrier begins to recede the gripping dies close so as to hold the pin firmly, and then said carrier recedes, drawing off from the pin and leaving it between the gripping dies in readiness for the upsetting of its head. While the pin is locked in the gripping dies in the manner above stated the piston, carrying the piston tube punch tube, and punch at its end will advance, crowding up the gage. The projecting end of the pin in front of the gripping dies will enter the punch tube, and the boss of said dies will enter the piston tube, the punch tube will stop against the face of the boss of the gripping dies before the end of the punch reaches the end of the pin, as shown in Fig 3, Sheet IIII. The piston, 100, will continue to advance, pressing the end of the punch against the end of the pin and causing said punch to crowd that portion of the pin which had entered the punch tube into the matrix in the gripping dies. The piston then recedes, withdrawing the piston tube from the boss of the gripping dies before said dies are unclasped. During the carrying movement of the second carrier the pin, which will have been taken hold of by said carrier near its point, will be crowded back between the fingers of said carrier so as to cause the point of the pin to project in order that it may be received into the female or receiving finishing die, 116, and when said carrier arrives at its delivering position it will hold the pin in the line between the two finishing dies with the head of the pin close to the matrix in the crown die 115 and the projecting point presented toward the orifice in the receiving die, 116, the bolt 119 which carries the receiving die in its end being in a retracted position. See Fig. 1, Sheet IIII. During the performance of the aforesaid delivering action of the first carrier the bolt 119 advances so as to bring the die 116 close to the side of the second carrier, and so much of the pin as projects from said carrier toward said die will be received into said die. The bolt 119 having arrived at the last named position stops and remains stationary for a time long enough to allow the second carrier to be withdrawn from its delivering position. The two carriers then simultaneously make their return movement to their respective receiving positions, in order to repeat the above described operations. When the second carrier moves away from its delivering position it draws off from the pin, leaving it in the receiving die, 116, and a further movement of the bolt, 119, bringing the die 116, against the crown die 115, compresses and finishes the head of the pin. The bolt 119 then recedes so as to be entirely out of the way of the second carrier before said carrier returns, bringing another pin. As the bolt 119 recedes the pin will be pushed partially out of the die, 116, by the slide, L, and the claw, 130, falling in close behind the receding die, will receive the pin in its fork and will catch and hold the pin by its head so as to allow said die to draw off from its point, after which the pin will fall from said claw into a receiver provided for the purpose of receiving it.

Though many of the individual parts of the machine herein described are the common elements of machinery heretofore in use, and although there are some of the parts and minor combinations employed in said machine which have heretofore been used in the process of making pins or which pertain particularly to machinery for making or assisting to make pins, to the invention of which parts and minor combinations I make no claim, yet I consider the general combination of machinery herein described, constituting a self-acting machine for converting wire into completely formed pins, as a new and improved machine for said purpose, and I accordingly claim, as my invention, and wish to secure by Letters Patent, the machine hereinbefore described; and I also claim as my invention, and wish to secure by Letters Patent, several of the subordinate parts or minor combinations herein described, which are embraced in the aforesaid general combination, without reference to the particular general arrangement of the machine in which said parts or combinations may be employed, in their application to the purpose of making pins, viz.:

1. The combination herein described, of parts for receiving the wire for the pin, from the feeder, holding the pin in the operation of pointing and releasing the pin after the point has been completed; the parts whereof are marked in the drawings with the following figures and letters of reference, viz.: 28, 29, 30, 30^{a}, 31, 32, 33, 33^{a}, 34, 35, 36^{a}, 36^{b}.

2. The table D, in connection with other parts constituting, together the combination herein described, of parts for conveying the pins by successive stages, from the feeder where the wire is received by the "pointing chucks" to the position wherein, the pins are withdrawn from said "chucks" by the "first carrier," and for turning around said chucks, holding the pins in the manner before described, in the successive operations of pointing the pins; which parts are marked in the drawings with the following letters and figures of reference, viz.: C, *h*, 25, *g*, 26, *e*, *f*, D, *d*, (1 to 8) A^{6} 27, 28 (*a* to *h*) 37, N, M.

3. The combination, herein described, of parts for producing the combined movements of the circular file, 38, by which the

points of the pins are formed, in the manner explained in the preceding description, which combination is represented, and the parts thereof are marked in the drawings with the following letters and figures of reference, viz.: C, *k*, *l*, 62, 63, 65, *j*, 48 (*a* and *b*) 47 46, 40, 38, 43, 44, 45, 60, A^9, 64, 50.

But I do not claim as my invention the combination herein described for adjusting the position of the ways 48, the parts of which are marked in the drawings with the following marks of reference, viz.: 52, 52^a, 48^c, 55, 59^a, 59^b, 58, 57.

4. The combination of parts herein described for withdrawing the pins from the "pointing chucks," and carrying, and introducing them between the gripping dies, which is represented in the drawings and the principal parts whereof are marked therein with the following letters and figures of reference, viz.: 67, 68, 69, 65, 72, 73, 76, 78, 80, *p* (1 to 4), C, *q* (1 to 4), 83, 81.

I do not claim as my invention any of the parts or minor combinations hereinbefore described for feeding in or cutting off the wire, for upsetting the heads of the pins or compressing them between finishing dies, or for getting the pins out of the die, 116, after the head is finished.

I do not claim the yoke, 125, nor the lever, 127, nor any part of the combination or arrangement by means of which they contribute to expel the pin from the die, 116, nor the claw 130, for drawing the pin entirely out of said die. Nor do I claim any individual parts of said machine, if detached therefrom, nor any minor or subordinate combinations into which said general combination may be subdivided for performing portions of the total operation of said machine, excepting the parts or subdivisions thereof which are specified and pointed out in the foregoing claims; and I make no claim to the invention of or to the exclusive privilege of making solid headed pins such as are made by the machine herein described.

JNO. I. HOWE.

Witnesses:

SHELDON BASSETT,

E. A. SAUNDERS.