(No Model.)

8 Sheets—Sheet 1.

E. A. MARSH.

MACHINE FOR ROUGHING OUT PINIONS.

No. 330,600. Patented Nov. 17, 1885.

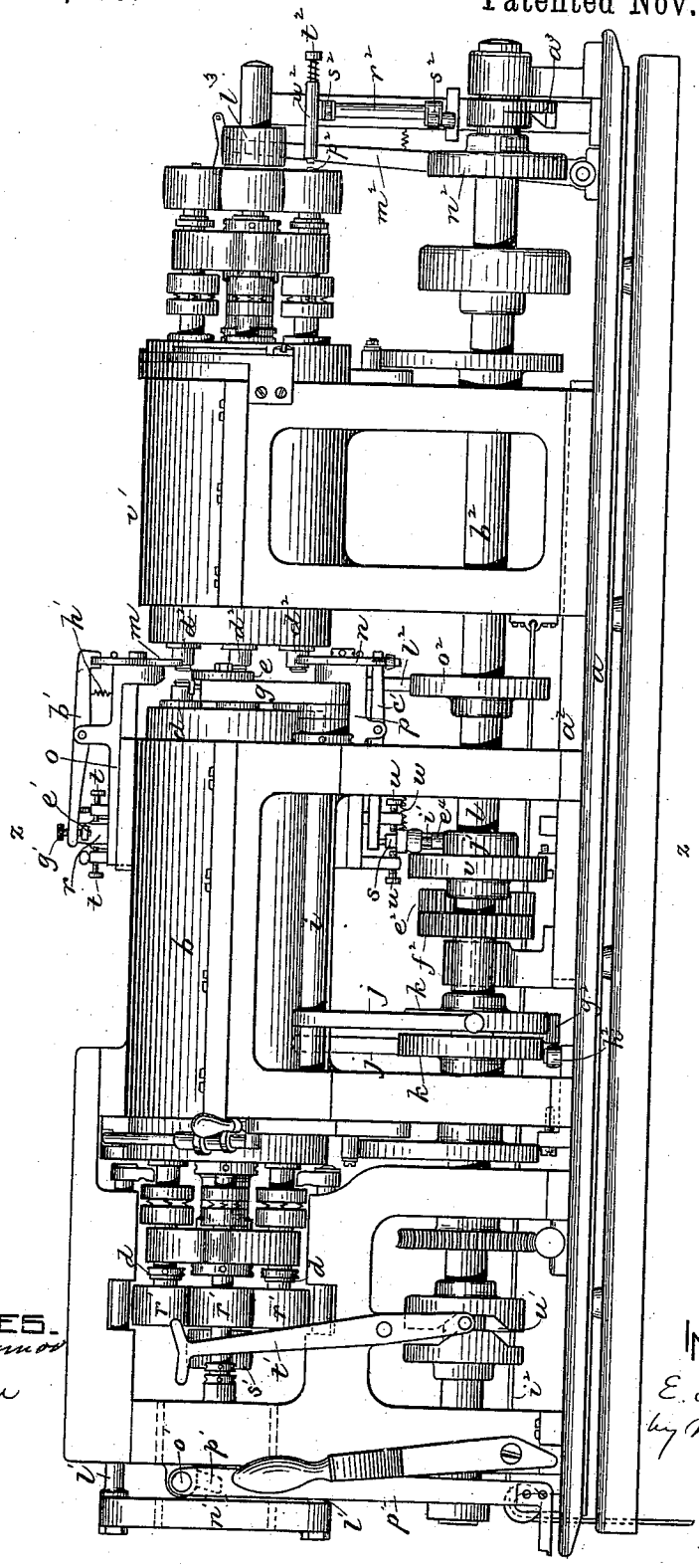


FIG. 1.

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Thos. E. A. Connor
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Attys.

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 8 Sheets—Sheet 2.

E. A. MARSH.

MACHINE FOR ROUGHING OUT PINIONS.

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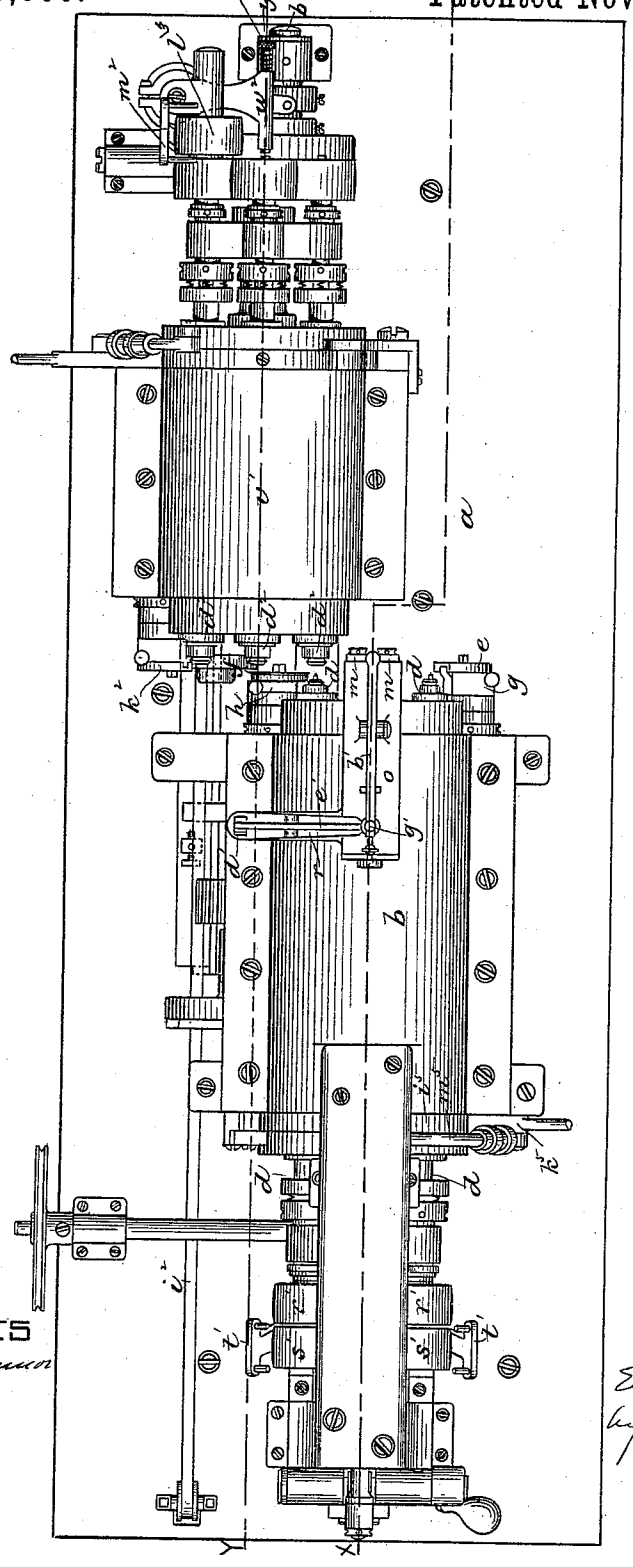


Fig. 2.

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E. A. MARSH.

MACHINE FOR ROUGHING OUT PINIONS.

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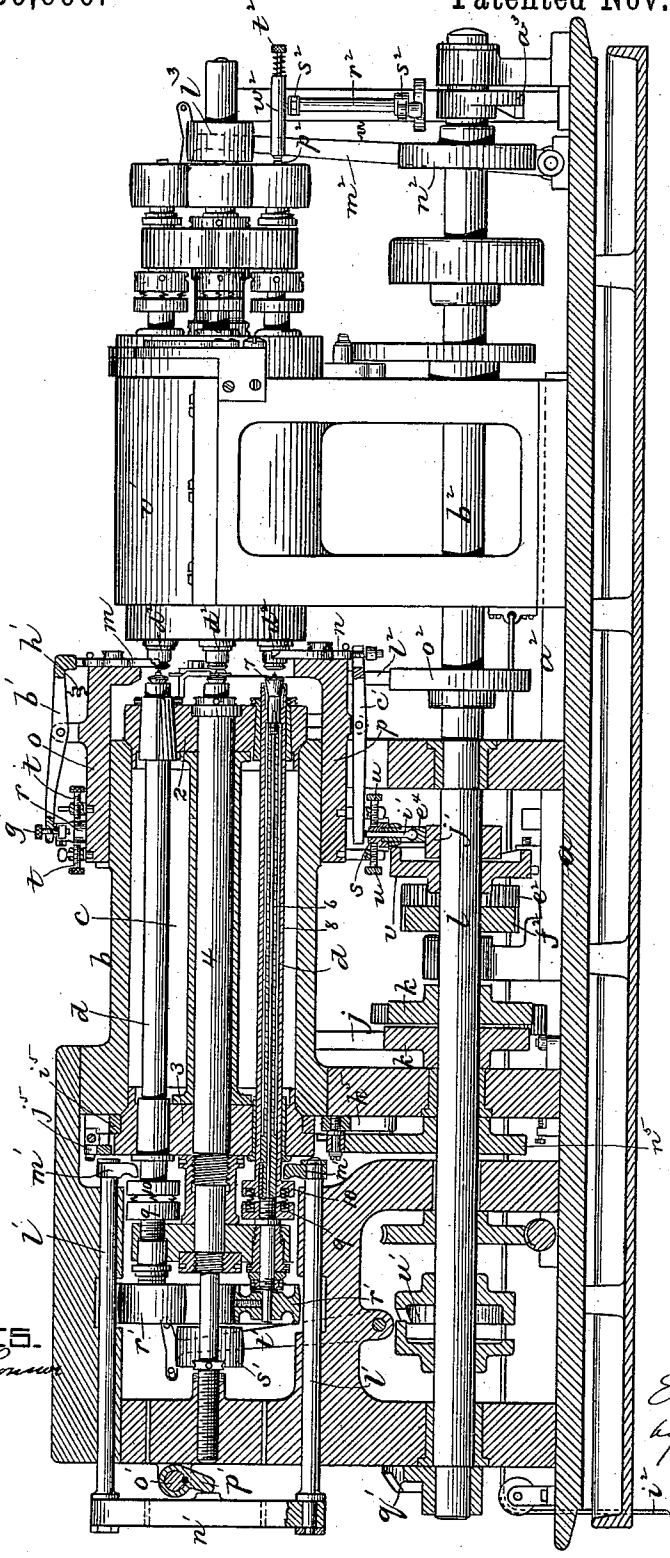


Fig. 5.

WITNESSES.
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E. A. MARSH.

MACHINE FOR ROUGHING OUT PINIONS.

No. 330,600. Patented Nov. 17, 1885.

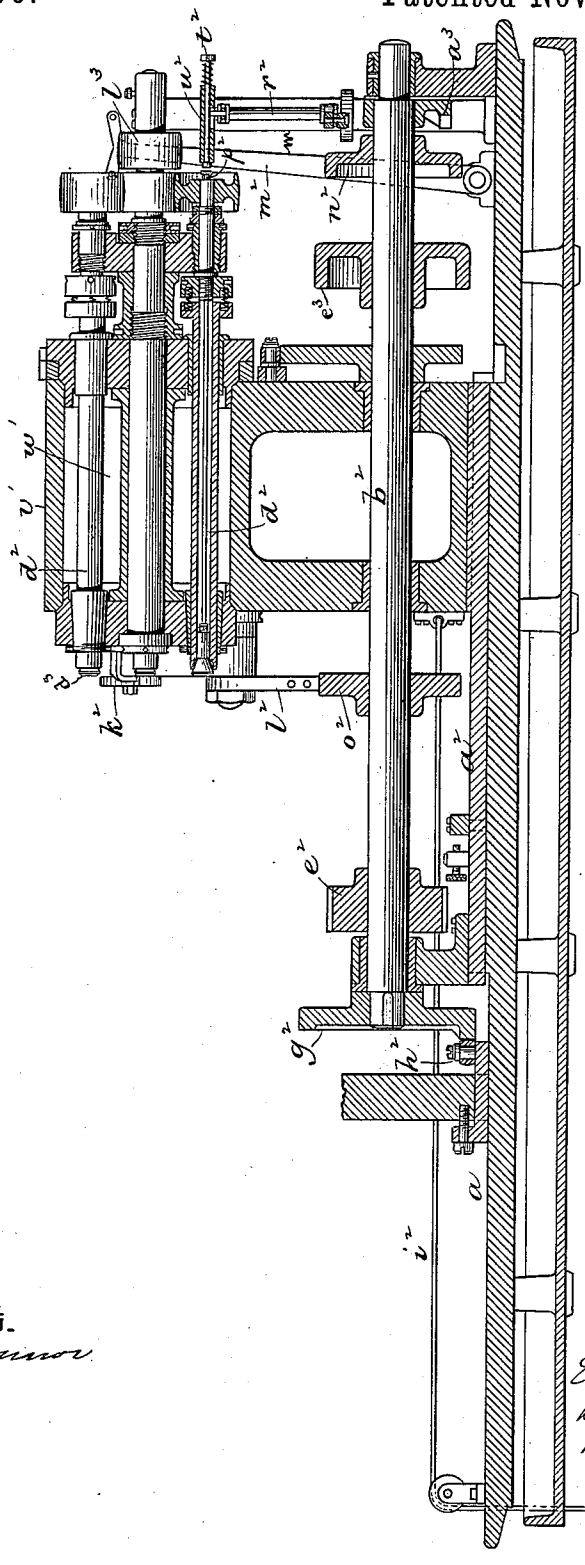


Fig 4.

WITNESSES.
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E. A. MARSH.

MACHINE FOR ROUGHING OUT PINIONS.

No. 330,600. Patented Nov. 17, 1885.

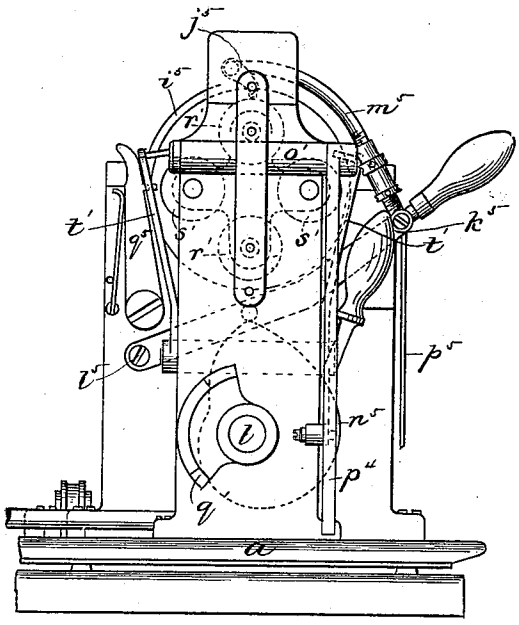


Fig. 5.

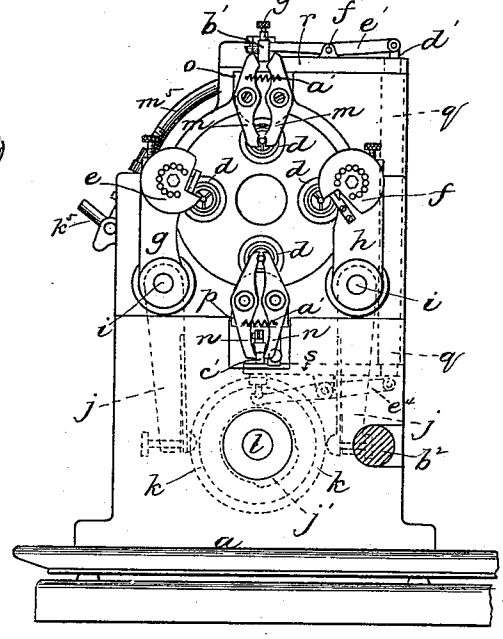


Fig. 6.

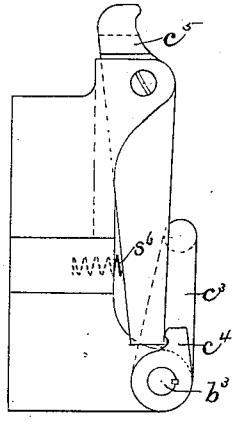


Fig. 7a

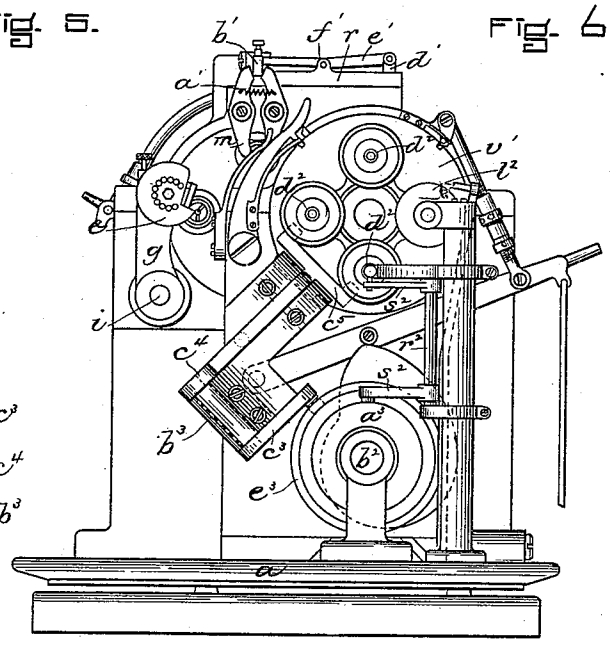


Fig. 7.

WITNESSES.

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E. A. Marsh

by Wright Brown

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E. A. MARSH.

MACHINE FOR ROUGHING OUT PINIONS.

No. 330,600. Patented Nov. 17, 1885.

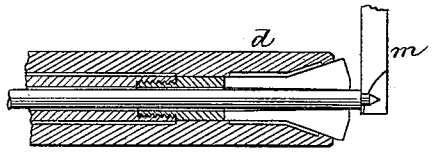


Fig. 8.

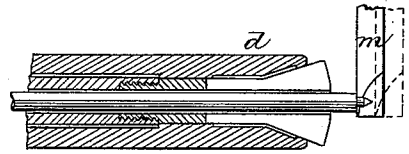


Fig. 9.

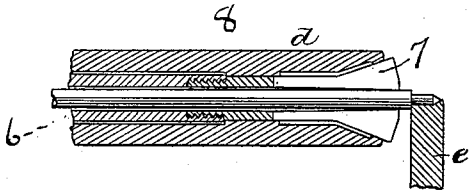


Fig. 10.

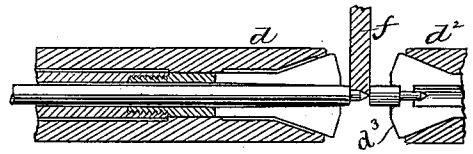


Fig. 12.

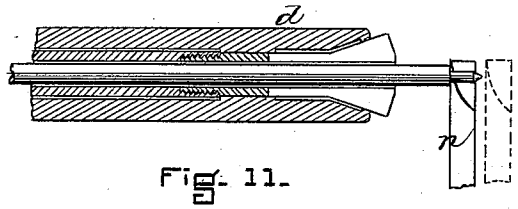


Fig. 11.

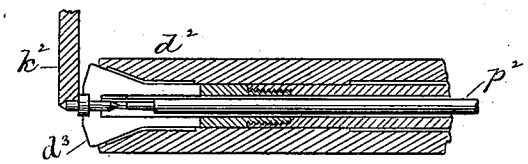


Fig. 13.

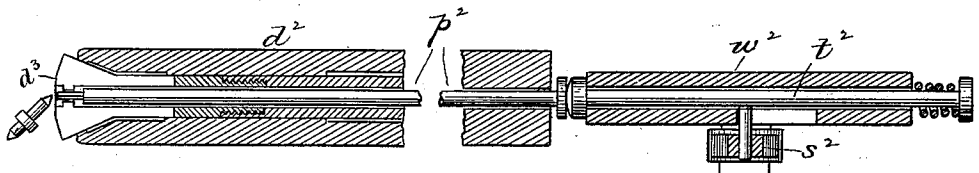


Fig. 14.

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(No Model.) 8 Sheets—Sheet 7.

E. A. MARSH.

MACHINE FOR ROUGHING OUT PINIONS.

No. 330,600. Patented Nov. 17, 1885.

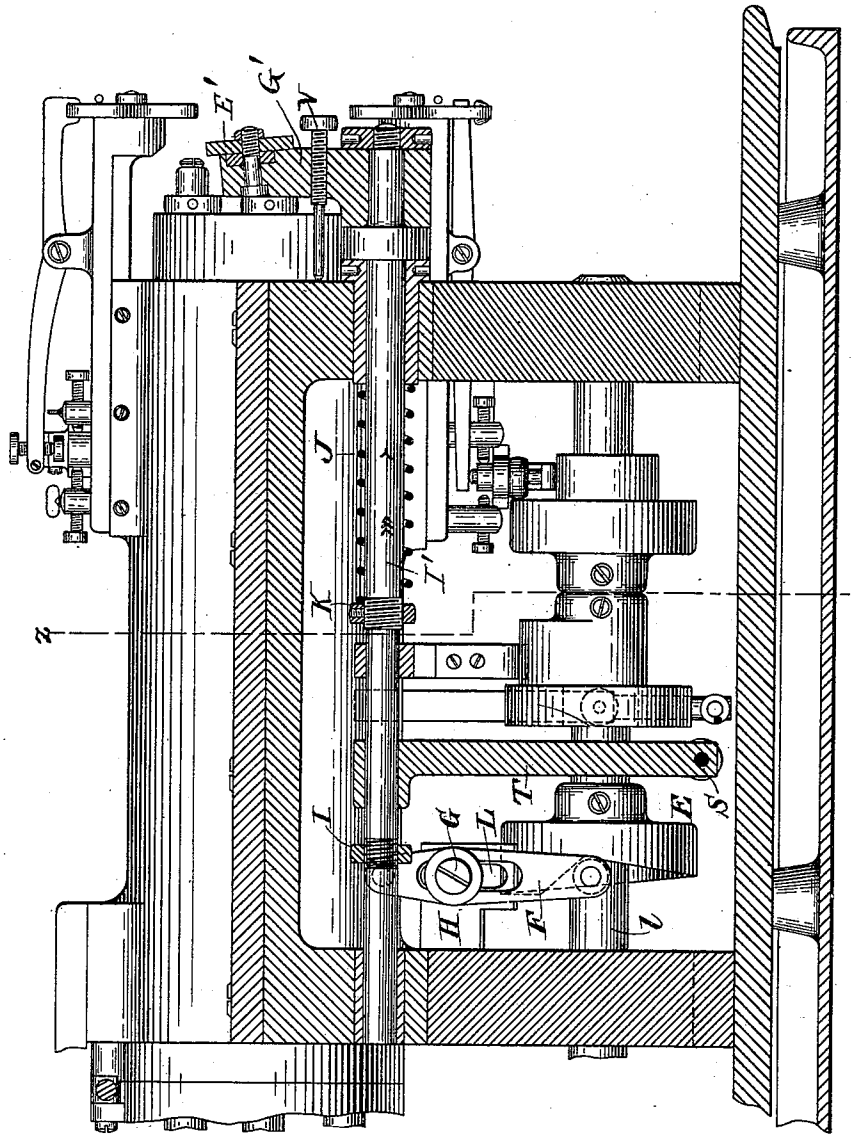


FIG. 15.

Witnesses.
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(No Model.) 8 Sheets—Sheet 8.

E. A. MARSH.

MACHINE FOR ROUGHING OUT PINIONS.

No. 330,600. Patented Nov. 17, 1885.

Fig. 16.

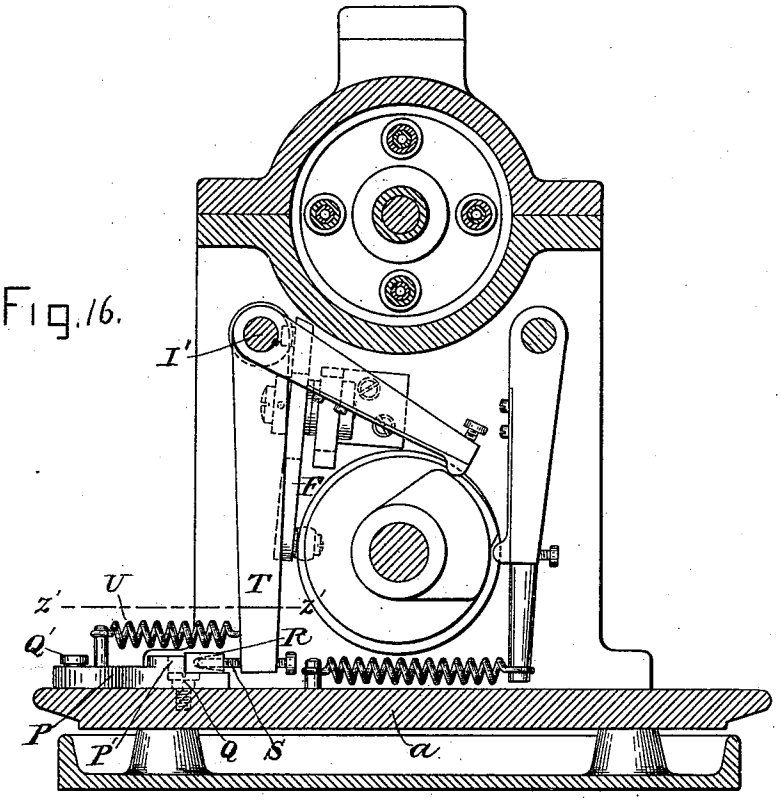


Fig. 16a.

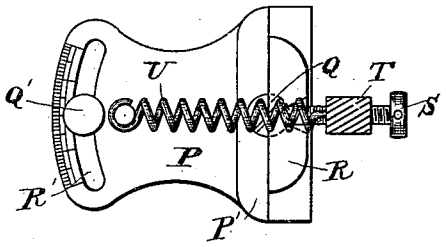
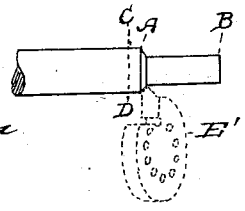


Fig. 17.



WITNESSES.
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UNITED STATES PATENT OFFICE.

EDWARD A. MARSH, OF NEWTON, MASSACHUSETTS.

MACHINE FOR ROUGHING OUT PINIONS.

SPECIFICATION forming part of Letters Patent No. 330,600, dated November 17, 1885.

Application filed July 17, 1885. Serial No. 171,850. (No model.)

To all whom it may concern:

Be it known that I, EDWARD A. MARSH, of Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Machines for Turning or Roughing Out Pinions, &c., of which the following is a specification.

This invention relates to automatic machines for making blank pieces from wire rods, giving such pieces an approximation to the form of the finished article, so that they can be completed by subsequent operations.

The machine hereinafter described is constructed to form blanks for watch-pinions, arbors, staffs, &c.; but the invention is not limited to such uses, as several of its features may be embodied in machines for forming blanks for other purposes.

In my invention I employ four or more spindles, each provided with a chuck for holding a wire rod, and all revolved at intervals around a common center, rod grasping and feeding devices alternating in position with the blank-forming tools, the arrangement being such that two or more rods are simultaneously grasped and drawn outwardly from their chucks, and two or more other rods are at the same time presented to the forming-tools, the two rods drawn outwardly being afterward simultaneously presented to the forming-tools. I also employ a second series of spindles each provided with chucks which face toward the first series, one spindle of each series being brought successively in direct axial line with one of the other series, to enable the spindles of the second series to move lengthwise toward the spindles of the first series, and take the blanks therefrom and present them to another forming-tool.

The chief object of the invention is to perform simultaneously several varied and successive operations on a number of pieces, so that a complete piece of work, the result of all of the operations, will be produced every time that any one of said operations is performed, all of which I will now proceed to describe.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a side elevation of my improved machine. Fig. 2 represents a top view of the same. Fig. 3 represents a section on line *x x*, Fig. 2. Fig. 4 represents a section on line *y y*, Fig. 2. Fig. 5 represents an end elevation of the head-stock and the portion of the mechanism behind it, as viewed from the left-hand end of Fig. 1. Fig. 6 represents an elevation of the opposite end of the head-stock. Fig. 7 represents an end elevation of the entire machine, as viewed from the right-hand end of Fig. 1. Fig. 7ª represents a side elevation of a part of the mechanism shown in Fig. 7. Figs. 8 to 14, inclusive, represent enlarged sectional views showing the different steps in the operation of forming a watch-pinion blank. Fig. 15 represents a side elevation and partial section of a part of the head-stock, showing a cutter adapted to move along the rod while reducing it. Fig. 16 represents a section on line *z z*, Fig. 15. Fig. 16ª is a detail taken on the line *z' z'*, Fig. 16. Fig. 17 represents a side view of the rod as reduced by the cutter shown in Fig. 15.

The same letters of reference indicate the same parts in all the figures.

In the drawings, *a* represents the bed-plate, on which is mounted a casing or head-stock, *b*, having a large cylindrical opening, in which is fitted a rotary head or drum, *c*, Fig. 3. Said head for lightness is made in the general form of a spool, and is composed of two disks or ends, 2 3, Fig. 3, connected by a longitudinal rod, 4, and bearing on the inner surface of the head-stock *b* at the ends of the latter, and a third disk or plate, 5, secured to the rod 4. In the head *c* are fitted to rotate four or more running spindles, *d*, placed at equal distances apart and equidistant from the axis of the head. Each running spindle is composed of an interior tube, 6, to which is attached the rod-holding chuck 7, having self-opening spring-jaws, and an outer tube, 8, Fig. 3, which is capable of endwise motion on the inner tube, and when moved in one direction closes the jaws of the chuck upon the rod, and when moved in the opposite direction allows said jaws to release the rod. This form of spindle is technically known as a "slide-spindle." The outer tube is moved forward to close the jaws of the chuck by means of springs interposed between flanges

9 10, formed on the two tubes, and is moved backward to release the jaws by means hereinafter described. The head *c* is rotated step by step a quarter of a complete revolution each step, to present each spindle successively to the feeding-jaws *m m*, the cutter *e*, the feeding-jaws *n n*, and the cutter *f*, hereinafter described. These movements of the head are effected by means of a ring, i^5, journaled on the periphery of the rear end plate, 3, of the head or drum, and having a spring-pawl, j^5, Fig. 5, adapted to engage with notches cut at equal distances apart in said plate, and mechanism for oscillating said ring upon the plate 3 to rotate the head *c* step by step. Said mechanism consists of a lever, k^5, pivoted at l^5, and connected by a rod, m^5, to the ring i^5, a cam, n^5, on the driving-shaft *l*, the periphery of which supports a stud or roller on the lever k^5, and a weight or its equivalent suspended by a cord, p^5, from the lever k^5, and holding the stud thereof against the cam n^5. The lever k^5 is alternately raised by the cam and depressed by the weight, and is thus imparting motion to the ring i^5, as will be readily seen. When the ring is being rotated backwardly by the upward movement of the lever, a projection on said ring strikes and throws out a latch, q^5, engaged with one of the notches of the plate 3, the pawl j^5 at the same moment engaging with another notch. The next depression of the lever k^5 causes the pawl j^5 to give the head *c* a partial rotation, the latch q^5 springing into the following notch and locking the head.

e and *f*, Figs. 2, 6, and 7, represent cutters formed in this case to reduce the wire rod in making watch-pinion blanks, said cutters being shown enlarged in section in Figs. 10 and 12. They are mounted, respectively, on swinging levers *g h*, affixed to rock-shafts *i i*, having arms *j j*, which bear against and are oscillated by cams *k k* on the driving or cam shaft *l*, so that the cutters *e f* are caused to simultaneously approach and recede from two of the running spindles at opposite sides of the center of the head *c*. The arrangement of the cutters with relation to the head or drum *c* is clearly shown in Fig. 6.

m m and *n n* represent two pairs of rod grasping and feeding jaws pivoted to slides *o p*, which are capable of moving lengthwise on the head-stock. Said jaws are arranged to grasp and feed wire rods in the two spindles which alternate with the spindles in operative relation to the cutters *e f*, thus simultaneously preparing said rods for the next simultaneous action of said cutters, the head *c* being rotated a quarter of a complete rotation after each action of the feeding-jaws and of the cutters, as hereinafter described.

The two pairs of feeding-jaws are operated in unison as follows: First, they are closed to grasp the ends of the rods projecting from the chucks; secondly, they are moved forward to feed the rods the required distance; thirdly, they are stopped after sufficiently feeding the rods; fourthly, they are opened to release the rods; fifthly, they are moved farther forward to clear the ends of the rods and permit the movement of the spindles to their next positions by the partial rotation of the head or drum *c;* and, lastly, they are returned to position to grasp the rods in the two spindles brought into operative relation with them by the last partial rotation of the head or drum. The outward and inward movements of the slides and jaws are effected by means of a vertical rock-shaft, *q*, journaled in the head-stock *b*, two arms, *r s*, affixed to said rock-shaft and projecting, respectively, between adjustable screws *t t* and *u u* in posts on the slides *o* and *p*, a cam, *v*, on the driving-shaft, and a spring, *w*, which presses the arm *s* against the cam *v*. The rotation of the cam causes the rock-shaft *q* to rock and oscillate the arms *r s*, which reciprocate the slides *o p*, said slides being first moved forward, then stopped, then again moved forward, and finally moved back to the starting-point. The wire-grasping ends of the jaws *m m n n* are normally opened or separated by springs *a' a'*, and are caused to close upon the rods in the spindles *d*, while the slides are moving outward or forward, by means of levers *b' c'*, pivoted, respectively, to studs on the slides *o p*, and projecting at their outer ends between the inner sides of the jaws *m m*. The lever *b'* is operated by a rod, *d'*, passing through the center of the rock-shaft *q*, a lever, *e'*, pivoted at its rear end to the rod *d'* and at its center to ears *f'* on the arm *r* of the rock-shaft *q*, its opposite end bearing against a screw, *g'*, in the rear end of the lever *b'*, a spring, *h'*, being employed to hold the screw *g'* against said lever *e'*. The lever *c'* is operated by a lever, e^4, pivoted at its center to the arm *s* of the rock-shaft and at its rear end to the rod *d'*, Figs. 3 and 6, and a rod, *i'*, interposed between the forward end of said lever e^4 and the rear end of the lever *c'*. (See Fig. 3.) These devices depress the ends of the levers *b' c'*, that project between the jaws, and thus close the jaws during the first forward movement of the slides *o p*, so that the rods are fed during said movement, and raise the levers so as to allow the jaws to separate during the next forward movement of the slides, and while they are moving back. The jaws, being thus caused to release the rods, move forward to clear them, as shown in dotted lines in Figs. 9 and 11, while the head is being rotated, and then return to position to grasp the rods in the next spindles, as shown in Fig. 8. The jaws *n n* are located farther from the end of the head *c* than the jaws *m m*, as shown in Figs. 1 and 3, and move each rod outwardly from the position to which it was drawn by the jaws *m m*, Figs. 9 and 10, to the position shown in Figs. 11 and 12, thus preparing the rod for the action of the severing-cutter *f*. (See Fig. 12.) The outer tubes of the two spindles that are in operative relation to the feeding-jaws are moved back to allow the chucks of those spindles to release the rods during the feed-

ing movement of the jaws by means of two parallel rods, l' l', Fig. 3, adapted to slide in guides in the fixed frame behind the head-stock, toes m' m' on said rods bearing against the flanges 10 10 of the two outer tubes, a yoke, n', connecting said rods, a rock-shaft, o', journaled in bearings on said frame, and a toe or arm, p', on said rock-shaft, bearing against the yoke n'. The rock-shaft o' has a lever, p^4, at one end, which has a stud that bears against a cam, q', on the shaft l, said cam causing the rock-shaft o' and its cam to turn and force the yoke n' and rods l' l' backwardly, and thus cause the toes m' m' to press back the outer tubes while the feeding-jaws are engaged with the rods and moving forward. The spindles are not rotated while they are presented to the feeding-jaws m m n n, but are rotated while presented to the cutters e f, to cause said cutters to act on the rods, the cutters being non-rotary. Each spindle has a pulley, r', affixed to its rear end, and the pulleys of the two spindles that are presented to the cutters e f are rotated simultaneously by one or more belts. Before each rotation of the head c, said belts are shipped automatically onto two loose pulleys, s' s', journaled on studs affixed to the rear frame of the machine, and when the rotary motion of the head is completed the belt is shipped onto the pulleys of the two spindles to be rotated. The shipping device consists of two arms or levers, t' t', pivoted to the frame, engaged with the belt at their upper ends, the lower end of one of said arms being engaged with a cam, u', on the driving-shaft.

v' represents a tail-stock, in which is journaled a head, w', having four spindles, d^2, constructed like the spindles d, but facing in the opposite direction. The head w' is partially rotated at intervals and locked after each rotation by means like those employed for rotating and locking the head c. The tail-stock is mounted on a plate or carriage, a^2, which is adapted to slide on ways on the bed-plate a in a direction parallel with the driving-shaft l.

b^2 represents a shaft, journaled in bearings on the carriage a^2 and movable therewith, said shaft being parallel with the shaft l and connected thereto by spur-gears e^2 f^2, secured to the two shafts, the gear e^2 being made longer than the gear f^2 to maintain the connection during the changes of position caused by the movements of the slide a^2. The shaft b^2 has a cam, g^2, which is pressed against a stud, h^2, on the bed-plate a by a weight, or its equivalent, depending from a cord, i^2, attached to the tail-stock, said weight and cam moving the carriage and tail-stock alternately in opposite directions. The tail-stock is so located that when both heads are locked in their operative positions the spindle d^2, at the inner or front side of the head w', is in line with that spindle d which is at the rear side of the head c, and is presented to the severing-cutter f, as shown in Fig. 2. As soon as the rod held by spindle d, last referred to, is in position, and before it is set in motion, the tail-stock is advanced toward it, one of its spindles being in direct axial line with it. The chuck d^3 in this tail-stock spindle being held open, by means hereinafter described, the half-completed blank or rod in spindle d passes into it, and the chuck d^3, being closed, grasps the rod or blank, and when the spindle d is set in motion it carries with it the tail-stock spindle d^2. The severing-cutter f then advances upon the rod and severs it. The tail-stock then recedes, carrying with it the severed blank. The head w' is then partially rotated to bring another of its spindles d^2 into line with the next spindle d presented to the severing-cutter, and to move the spindle holding the last blank either to or toward a cutter, k^2, which is mounted on a lever, l^2, pivoted to a boss on the tail-stock, and is formed to reduce the ends of the blanks which project from the spindles d^2. (See Fig. 13.) Said cutter is preferably located so that two partial rotations of the head w' are required to move each blank to it from the severing-cutter, although it may be arranged so that one partial rotation will be sufficient. When the blank is presented to the cutter k^2, the spindle holding the blank is rotated by a belt, which is moved upon the pulley of that spindle from a single loose pulley, l^3, by a shipping-lever, m^2, operated by a cam, n^2, on the shaft b^2. While the spindle is being rotated the cutter k^2 is moved against the blank by means of a cam, o^2, on the shaft b^2, until the blank is reduced, as shown in Fig. 13, when the cutter k^2 retires and the belt is moved by the shipper upon the loose pulley l^3. The next partial rotation of the head w' brings the spindle having the completed blank into line with a device for operating the ejecting-rod p^2, with which each spindle d^2 is provided, said device being a rock-shaft, r^2, journaled in fixed bearings and having two arms, s^2 s^2—one engaged with a pin affixed to a rod, t^2, which slides in a fixed guide, w^2, and bears against the rear end of the ejecting-rod p^2, and the other arm engaged with a cam, a^3, on the shaft b^2. Said cam oscillates the rock-shaft r^2 and causes its arm s^2 to move the ejecting-rod forward and eject the completed blank, as shown in Fig. 14, the chuck-jaws of the spindle being opened at the same time to permit such ejection. The means here shown for opening the chucks, both of the spindle holding the completed blank and of the spindle about to receive a blank from one of the head-stock chucks, consists of a rock-shaft, b^3, journaled in a fixed bracket, two arms, c^3 c^4, affixed to said rock-shaft, the arm c^4 acting upon a bifurcated arm, c^5, formed to bear against the flanges of the outer tubes of both of the spindles d^2 whose chucks are to be opened, and a cam, e^3, on a shaft engaged with the other arm, c^3. As the cam e^3 recedes, a spring, s^6, Fig. 7ª, under lever or arm c^5, causes it to recede from the flanges of spindle d^2, which are then pressed forward and close the chuck.

The devices for opening said chucks are omitted from Figs. 1 and 3, to avoid confusion.

From the foregoing description it will be seen that the successive steps in the formation of each blank are as follows: The wire from which the pinions are to be made is supplied to the machine in lengths about equal to the length of the rotary head or drum or the spindles therein. The wire rod, when in its first position, is drawn partly out of the spindle by the jaws *m m*, Fig. 9, the head *c* is partly rotated to bring the rod to the cutter *e*, Fig. 10, and then locked, and while it is locked the spindle *d* is rotated, and the cutter *e* moved forward and then back, thus acting on and then leaving the rod. Then the head is given another partial rotation to bring the rod to the jaws *n n*, Fig. 11, and again locked. The rod is then moved farther forward by the jaws *n n*, and is moved by the next partial rotation of the head to the cutter *f*, Fig. 12, where it is grasped by one of the chucks d^2, and again rotated, and is acted on and severed by said cutter, the severed blank being left in the chuck of the spindle d^2 in line with it. The blank is then advanced to the cutter k^2, Fig. 13, and reduced at its other end, and finally ejected, Fig. 14. It will also be seen that as many as seven blanks are simultaneously acted on. The number of said spindles and the accompanying tools may be varied as the nature of the work may require, and although I have shown four spindles in the head-stock and four in the tail-stock, and three cutters or working-tools, my invention is by no means limited to these numbers.

The means described for rotating a part only (one or more) of the spindles when the head is in working position may be used in other machines—for example, in the screw-machine shown in my application for Letters Patent filed herewith. Some of the cutters may be rotated, however, instead of the spindles (the latter being held stationary) without departing from the spirit of my invention.

I do not limit myself to the joint use of both heads, as in some cases the head *c* may be used independently, the blank or article being entirely formed by the cutters accompanying said head; nor do I limit myself to the described relative arrangement of the feeding jaws and cutters accompanying the head *c*, nor to the form of said cutters, nor to the form of the finishing-cutter accompanying the head *w'*, nor to the means for transferring the blanks from the spindles of the head *c* to the head *w'*.

In my application for Letters Patent for a screw-machine, above referred to, I have shown a head having a series of spindles adapted to hold wire rods, feeding devices, and cutters co-operating with said spindles, whereby the wire is fed, reduced to form a shank, threaded on the shank, and severed at a suitable distance from the shank to form a screw-head, and a second head having a series of spindles which are moved lengthwise, one at a time, to take the screw from the spindles of the first head (instead of being moved with the entire head in which they are located, as in the present case) and present the heads of the screws to a slotting saw or cutter. I wish, therefore, to be understood as regarding said machine as coming within the scope of the present invention.

The cutters accompanying the head *c* may be constructed to operate on blanks for other purposes.

In Fig. 15 I have shown the cutter E', to which the rod is first presented, mounted on an arm, G', which is capable not only of oscillating, as already described, to move the cutter toward and from the rod presented to it, but also of moving lengthwise of the rod while operating thereon, so that it can turn or reduce a section of the rod of greater length than the width of the cutter in forming an elongated blank—for example, such as is shown in Fig. 17, this being a blank for a sleeve to be partially split lengthwise to form spring-fingers, and placed in a watch-case pendant to hold the winding-bar in different longitudinal positions. The blank is reduced from A to B by the traverse motion of the cutter, and afterward severed from the rod at C D by the severing-cutter *f*. In this case the cutter E' is mounted obliquely on the arm G', so as to give clearance to the cutter while it advances upon the rod, as shown by dotted lines in Fig. 17. The rock-shaft I', to which the arm G' is affixed, is oscillated by the means already described to move the cutter E' toward and from the work, and is reciprocated longitudinally by a cam, E, on the shaft *l*, a lever, F, pivoted at G to a fixed arm or bracket, H, and bearing at one end against the cam E and at its other end against a collar, I, on the shaft I', and a spring, J, interposed between the head-stock frame and a collar, K, on the shaft. The cam E and lever F move the rock-shaft I' in the direction indicated by the arrow, Fig. 15, when the cutter E' is withdrawn from the work, and the spring J moves the rock-shaft in the opposite direction when the cutter is presented to the work. The length of the endwise movement thus imparted to the rock-shaft may be regulated by adjusting the lever F on its pivot, the lever having a slot, L, for this purpose. An adjustable stop-screw, V, is also attached to the cutter-arm, so as to arrest the endwise motion of the cutter E' at any desired point. The rock-shaft I' may be slightly rotated, so as to move the cutter either inwardly or outwardly while it is acting on the work, and thus cause it to impart a tapering form to the blank. To this end I employ a graduated plate, P, pivoted at Q to the bed *a*, and having a guide, P', against which bears a slide or shoe, R, having a socket in one side which receives a pin or adjusting-screw, S, in an arm, T, attached to the rock-shaft *i*. The plate P may be secured to the bed with the guide P' either parallel with the rock-shaft *i* or at any desired angle thereto, by a thumb-screw, Q', passing through a slot, R', in the plate concentric with the pivot. The shoe or slide R

moves with the rock-shaft, and is held in contact with the guide P′ by a spring, U. When the guide P′ is parallel with the rock-shaft, the latter in moving endwise is not rotated, and the cutter moves in a line parallel with the axis of the rod on which it acts; but when the guide is set at an angle to the rock-shaft it gives the shoe a lateral movement, which partly rotates the rock-shaft and causes the tool *e* to move at an angle with the axis of the rod, and thus give the latter a tapering form, governed by the adjustment of the guide. The guide P may, if desired, be made curved or irregular, instead of straight, so as to give the desired form to the work. If desired, a drilling or reaming tool may be used to form a longitudinal hole in the center of the blank.

I claim—

1. The combination of a rotary head or drum, a series of spindles mounted thereon and adapted to hold wire rods to be converted into blanks, mechanism for rotating said head step by step to cause each spindle to assume a series of working positions, devices for locking the head in each working position, and rod-feeding mechanism, substantially as described, operating independently of the head or the spindles therein, and cutting devices and operating mechanism therefor arranged in series, to which the wire rods are presented by the step-by-step rotations of the head, the arrangement being such that each spindle is presented successively to the several devices of said series, and said devices operate simultaneously on the several rods held by the series of spindles, as set forth.

2. The combination of a rotary head having a series of running spindles, mechanism for rotating said head step by step, and devices for locking it after each step to cause each spindle to occupy a series of working positions, a plurality of cutting or reducing tools and mechanism to operate them, said tools being arranged to act simultaneously on wire rods held by two or more of the spindles when the latter are in their working positions, and a plurality of rod-feeding devices and mechanism to operate them, said feeding devices alternating in position with the cutting-tools and operating simultaneously therewith to prepare two or more rods for the action of the tools to which they are next presented, as set forth.

3. The combination of a rotary head having a series of running spindles, mechanism for rotating said head step by step, and devices for locking it after each step to cause each spindle to occupy a series of working positions, a plurality of cutting or reducing tools and mechanism to operate them, said tools being arranged to act simultaneously on wire rods held by two or more of the spindles when the latter are in their working positions, mechanism, substantially as described, whereby the spindles are rotated when presented to said tools, and a plurality of feeding devices and mechanism to operate them, said feeding devices alternating in position with the cutting-tools and operating simultaneously therewith, as set forth.

4. The combination of two rotary heads or drums, relatively arranged as described, two series of spindles mounted in said drums, one series being adapted to hold wire rods and the other series to hold the partially-formed articles, mechanism for rotating said heads step by step, locking devices for locking said heads in each position to which they are rotated, rod feeding and cutting devices and operating mechanism therefor, co-operating with the spindles in the first head, mechanism, substantially as described, whereby the spindles of the second head are caused to take the partially-completed articles from the spindles of the first head, a finishing-cutter to which said articles are presented by the step-by-step rotations of the second head, and means for ejecting the completed articles from the spindles holding them, as set forth.

5. The combination of a head-stock, a rotary head, *c*, journaled therein, a series of spindles mounted in the head, a plurality of cutters and a plurality of feeding devices alternating in position with the cutters, mechanism for simultaneously operating said cutters and feeding devices, mechanism for rotating the head step by step, devices for locking the head in a working position after each step, a tail-stock, a head, *w′*, journaled therein and located with its axis out of line with the axis of the head *c*, mechanism for rotating said head *w′* step by step, and devices for locking it in a working position after each step, a series of spindles journaled in the head *w′*, one of said spindles being in line with a spindle of the head *c*, when both heads are in their working positions, means, substantially as described, whereby the spindle of the head *w′* is caused to grasp a blank held by the coinciding spindle of the head *c*, and a cutter to which the blanks grasped by the spindles of the head *w′* are presented by the partial rotation of the latter, as set forth.

6. The combination of a rotary head having a series of running spindles, mechanism for rotating said head step by step and devices for locking it after each step to cause each spindle to occupy a series of working positions, a plurality of cutters and mechanism to operate them, said cutters being arranged to act simultaneously on wire rods held by two or more of the spindles when the latter are in their working positions, a plurality of rod-feeding devices and mechanism to operate them, said feeding devices alternating in position with the cutting-tools and operating simultaneously therewith, a second rotary and longitudinally-movable head having a series of spindles and arranged as described relatively to the other head, mechanism for rotating the second head step by step and for locking it in a working position after each step, mechanism for moving the second head toward and from the other head while in each of its working posi-

tions, and thereby causing it to advance toward and recede from the other head, means for opening the jaws of one of the spindles of the second head while it is moving forward, and thereby causing said spindle to grasp a blank held by a spindle of the other head, a cutter to which the blanks held by the spindles of the second head are successively presented by the partial rotation of the latter, mechanism to operate said cutter, means for rotating each spindle presented to said cutter, and ejecting devices, substantially as described, whereby the completed blanks are removed from the spindles of the second head, as set forth.

7. The combination of a rotary head, a series of running spindles mounted therein, each having a pulley at its rear end, mechanism for rotating said head step by step and devices for locking it after each step, one or more loose pulleys on fixed bearings arranged to coincide with one or more of the spindle-pulleys when the head is locked in working position, one or more driving-belts, and mechanism, substantially as described, whereby said belts are alternately moved, first, onto the spindle pulley or pulleys, coinciding with the loose pulley or pulleys when the head is locked, and, secondly, onto the loose pulley or pulleys to permit the rotary movement of the head, as set forth.

8. The combination of a rotary head, a series of running-spindles mounted therein, mechanism for rotating said head step by step and devices for locking it after each step, the cutters *e f* and their operating mechanism, means for rotating the spindles presented to said cutters, the feeding-jaws *m m* and *n n*, alternating in position with said cutters, the jaws *m m* being nearer the head than the jaws *n n*, mechanism, substantially as described, whereby said jaws are simultaneously closed upon the wire rods, moved forward, opened to release the rods, moved additionally forward, and then returned to their starting position, and mechanism, substantially as described, whereby the jaws of the spindles are opened while the rods are being moved forward by the feeding-jaws, as set forth.

9. The combination of the head-stock, the rotary head and its operating and locking mechanism, the running spindles mounted in the head, the cutters and their operating mechanism, the feeding-jaws *m m* and *n n*, provided with springs *a' a'*, the slides *o p* upon the head-stock, to which said jaws are pivoted, the levers *b' c'*, pivoted to standards on the slides, and the mechanism whereby said slides are reciprocated and the levers *b' c'* oscillated, as set forth.

10. The combination of the reducing-cutter, the head having a series of spindles, mechanism for presenting said spindles successively to said cutter, and mechanism for giving said cutter an inward and outward and a traversing movement, as set forth.

11. The combination of the reducing-cutter, the head having a series of spindles, mechanism for presenting said spindles successively to the cutter, mechanism for giving said cutter an inward and outward and a traversing motion, and adjustable devices for guiding the cutter in its traversing motion, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 11th day of July, 1885.

EDWARD A. MARSH.

Witnesses:
C. F. BROWN,
H. BROWN.