No. 819,623. PATENTED MAY 1, 1906.

O. H. WATKINS & C. F. SKELLENGER.

WIRE WORKING MACHINE.

APPLICATION FILED DEC. 28, 1904.

4 SHEETS—SHEET 1.

Fig. 1.

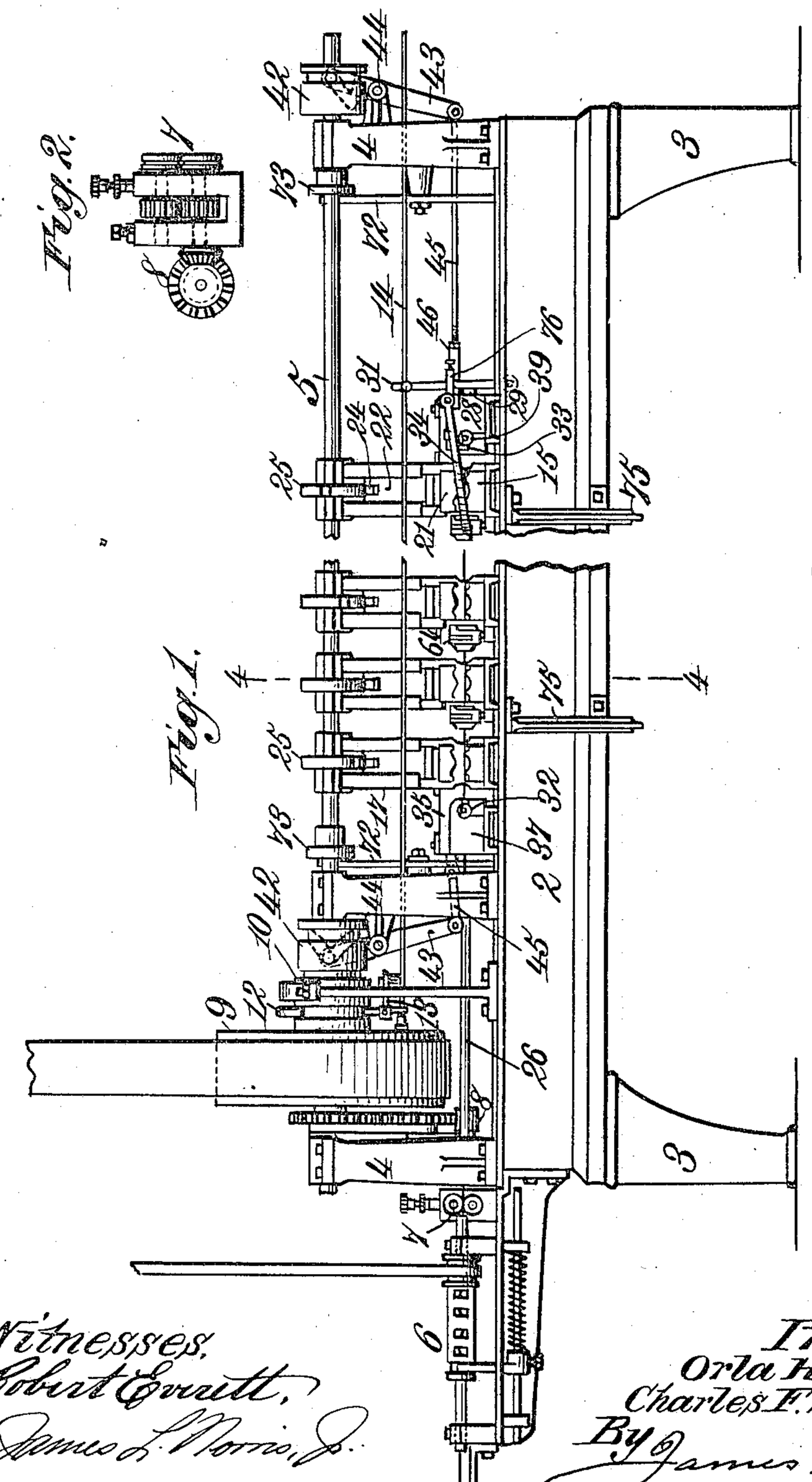
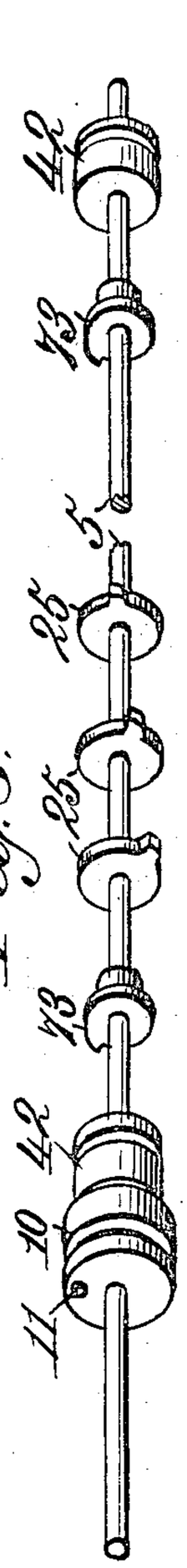


Fig. 2.

Fig. 3.



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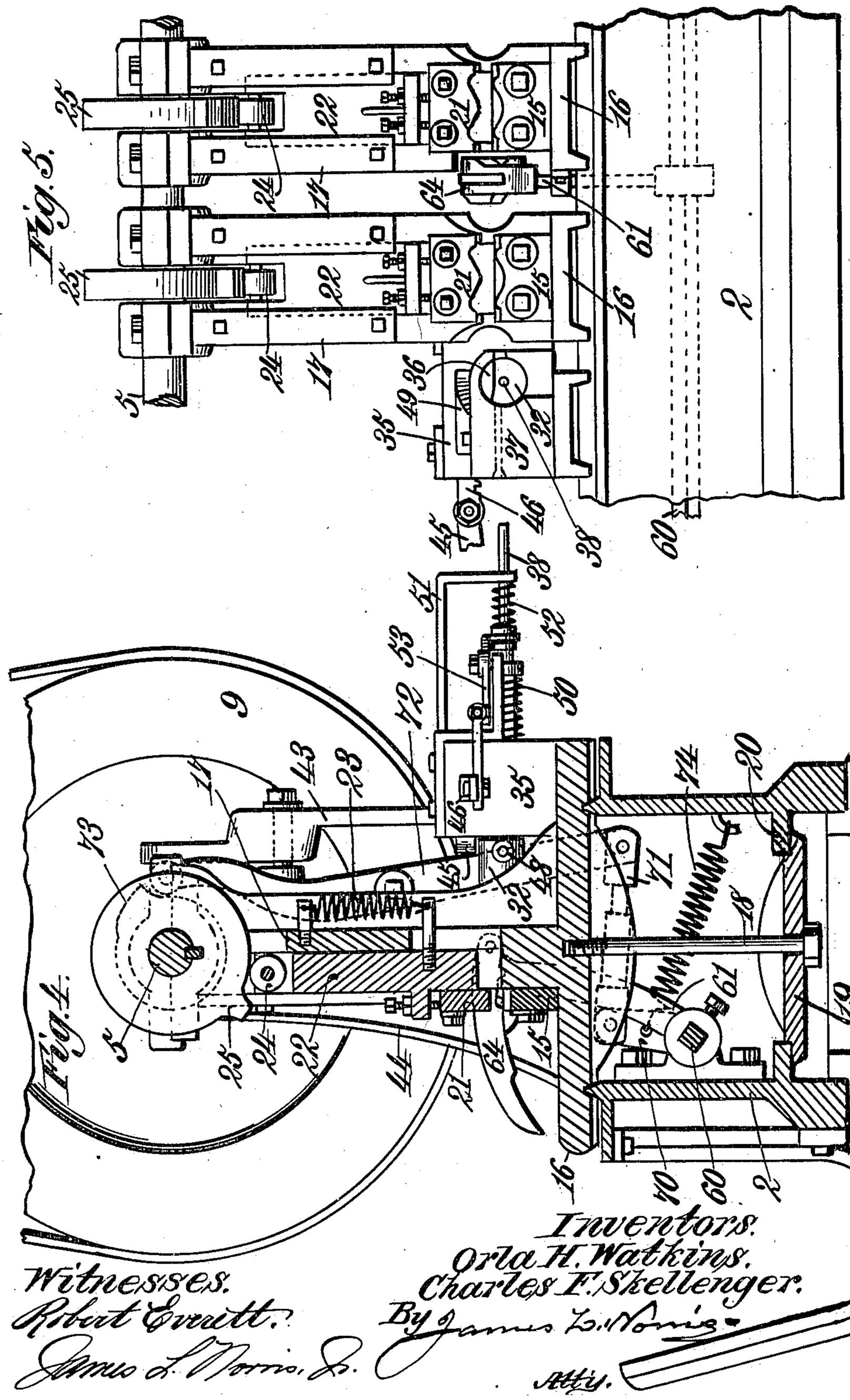
4 SHEETS—SHEET 2.

Fig. 5.



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4 SHEETS—SHEET 3.

Fig. 6.

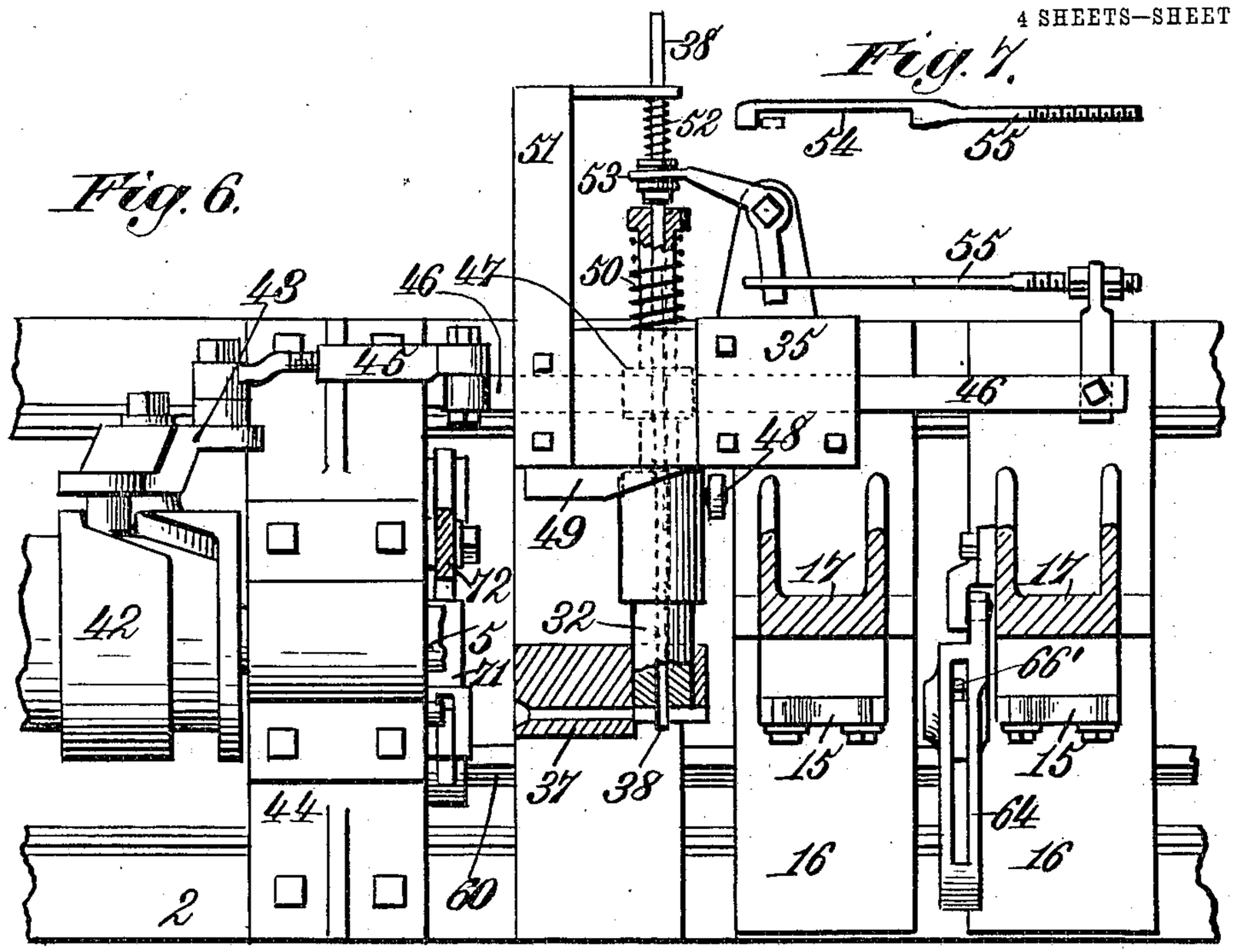


Fig. 7.

Fig. 8.

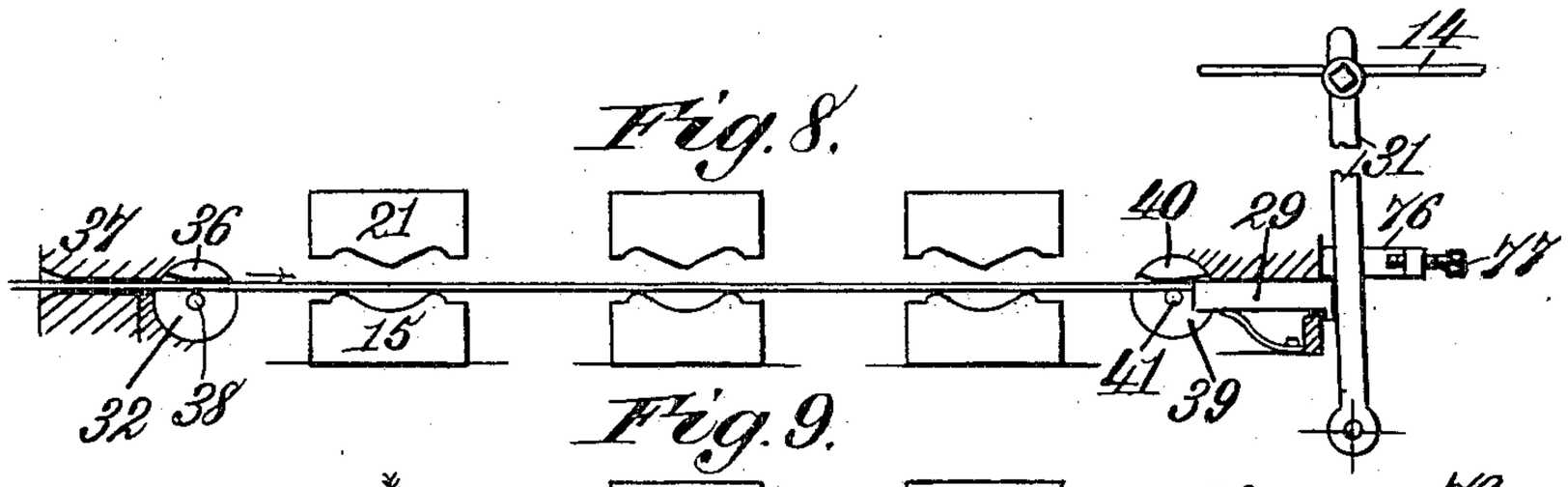


Fig. 9.

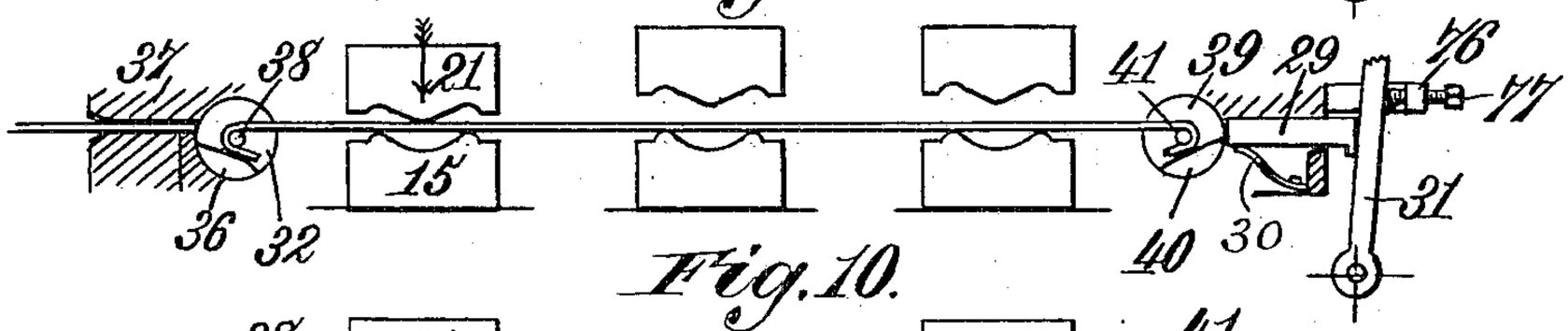
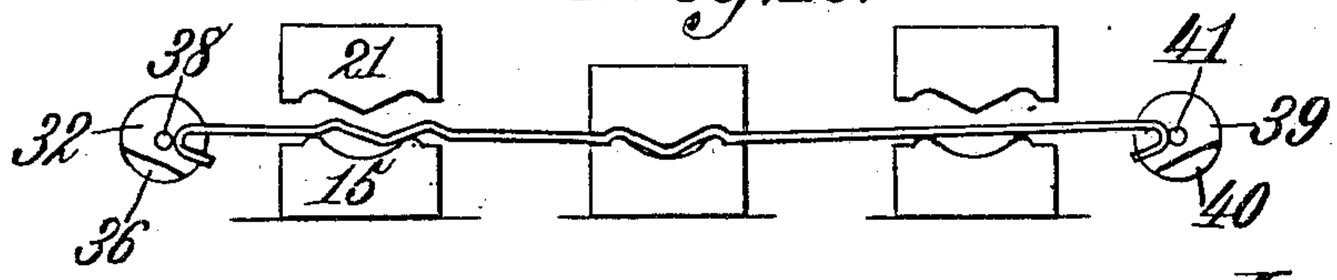


Fig. 10.



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4 SHEETS—SHEET 4.

Fig. 11.

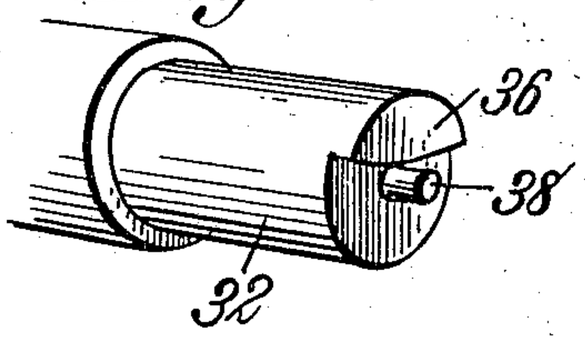


Fig. 12.

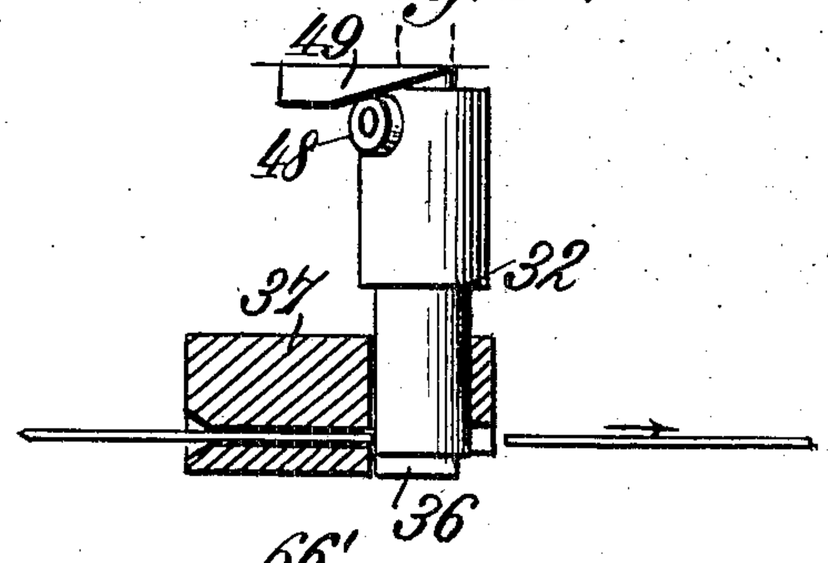


Fig. 13.

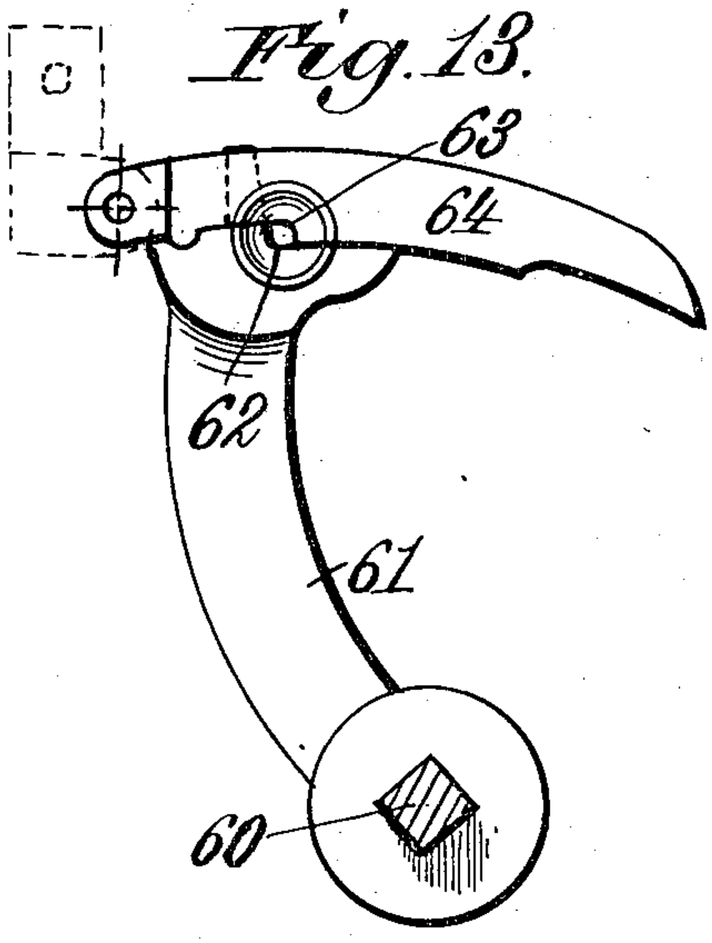


Fig. 14.

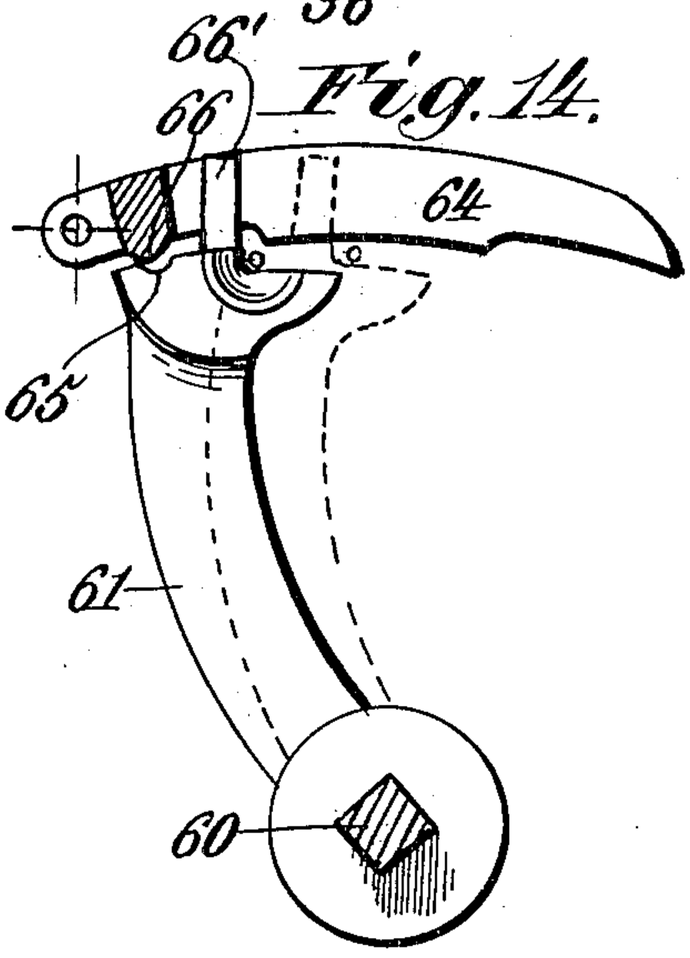
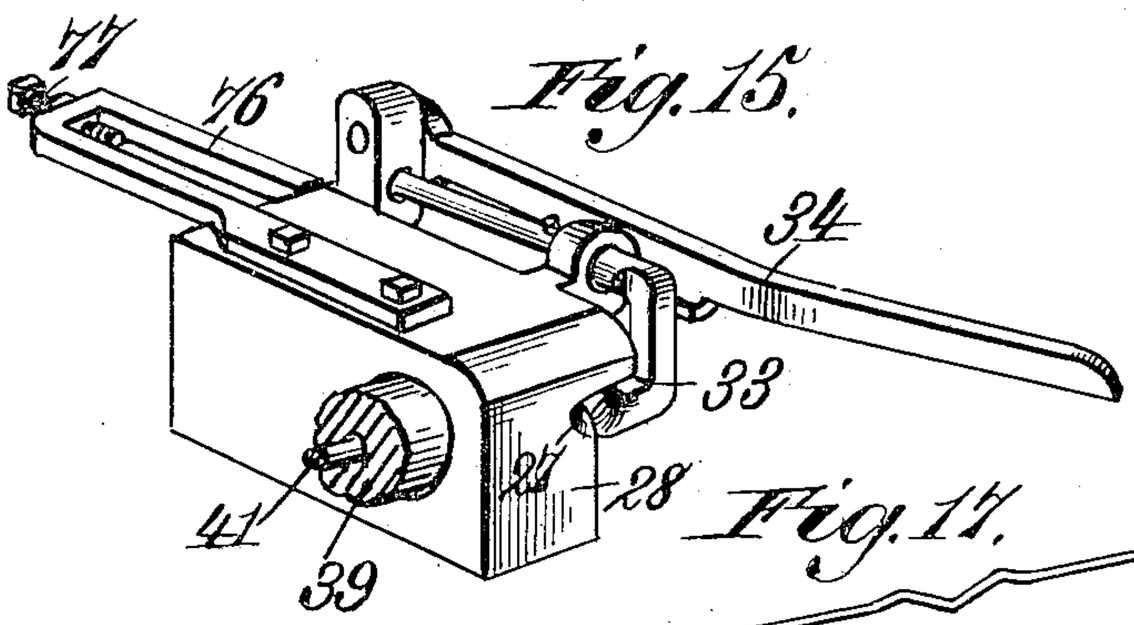


Fig. 15.



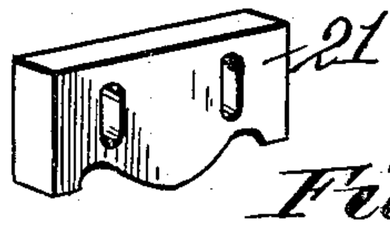


Fig. 16.

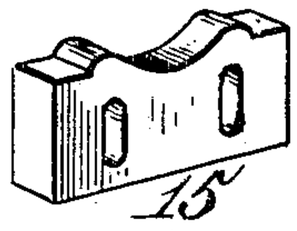


Fig. 17.

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UNITED STATES PATENT OFFICE.

ORLA H. WATKINS AND CHARLES F. SKELLENGER, OF CLINTON, IOWA, ASSIGNORS TO BENJAMIN F. WINDSOR, OF KENOSHA, WISCONSIN.

WIRE-WORKING MACHINE.

No. 819,623. Specification of Letters Patent. Patented May 1, 1906.

Application filed December 28, 1904. Serial No. 238,685.

To all whom it may concern:

Be it known that we, ORLA H. WATKINS and CHARLES F. SKELLENGER, citizens of the United States, residing at Clinton, in the county of Clinton and State of Iowa, have invented new and useful Improvements in Wire-Working Machines, of which the following is a specification.

This invention relates to a wire-working machine. The machine may be effectively employed for various purposes, although in practice it has been found highly advantageous in the formation of wire rods of a kind peculiarly adapted to a spring structure employed in the make-up of various articles of furniture.

In the drawings accompanying and forming a part of this specification we represent one effective organization embodying our invention and which we will set forth in full in the following description. The machine thus represented is arranged to form with accuracy and rapidity crimps or compound bends in a wire blank or rod at preselected distances and also to form on the ends of said blank hooks or bends, so that the finished product can be readily connected to other wires of a spring structure.

Referring to the drawings, Figure 1 is a front elevation of a wire-working machine embodying our invention and showing an intermediate portion thereof removed. Fig. 2 is a detail view in elevation of wire-feeding rolls and certain power-transmitting gears. Fig. 3 is a perspective view of a shaft and certain cams and other devices carried thereby. Fig. 4 is a transverse sectional elevation taken on the line 4 4 of Fig. 1. Fig. 5 is a front elevation of an intermediate part of the machine. Fig. 6 is a sectional top plan view of a portion of the machine at the head end thereof. Fig. 7 is a detail in elevation of an actuator. Figs. 8, 9, and 10 are diagrammatic views of the cutting, bending, and die mechanisms, Figs. 8 and 9 showing also a part of the means for controlling the action of the shaft shown in Fig. 3, for example. Fig. 11 is a perspective view of the front end of the cutter. Fig. 12 is a top plan view of the same and also of certain associated parts. Figs. 13 and 14 are sectional side elevations of a guiding and ejecting device. Fig. 15 is a perspective view of certain guiding and controlling devices. Fig. 16 is a similar view of the upper and lower dies shown as separated. Fig. 17 is a similar view of the article made by the machine constructed as hereinafter described.

Like characters designate like parts in all the views.

The framing for supporting the different parts of the machine may be of any suitable character, being represented as involving in its construction a bed 2 of any desirable size or material, from the head and tail ends of which the legs, each denoted by 3, depend. Upon the opposite ends of the bed the standards or uprights 4 rise and constitute a partial support for the shaft 5, disposed longitudinally of the machine.

In the machine shown in the drawings we feed thereinto from a suitably-mounted reel (not illustrated) wire and intermittently sever the wire into a predetermined length to constitute a blank. After the production of the blank we form in the same, and in the present instance in succession, a series of crimps and also shape the ends of the blank to present hooks. Each crimp is in the nature of a compound bend consisting of two deflected portions and an intermediate oppositely-deflected portion, the several crimps being created by successively and independently operative die mechanisms hereinafter more particularly described.

Before the wire is cut it is fed through a suitable straightening device, the one represented being denoted in a general way by 6, and being of a familiar type a detailed description of the same is unnecessary. After the wire leaves the straightening device it is passed between the superposed feed-rolls, each designated by 7, which positively advance the leading or free portion of the wire toward the cutting, crimping, and bending mechanisms. One of the rolls shown in the present case is represented as connected by a gearing (designated in a general way by 8) with a driver, as 9. The driver is illustrated as consisting of a pulley running loose on the shaft 5 and adapted to be operatively connected at regular intervals with said shaft and in such a way as to impart to the latter one full turn.

Rigidly united with the shaft 5 in any desirable manner is what is known in a number

of arts as a "one-revolution clutch," (denoted in a general way by 10,) a detailed description of which is not necessary. The clutch involves in its make-up a spring-actuated bolt, as 11, normally held retracted by a latch, as 12, suitably mounted on the framework of the machine and actuated in a direction to effect the release of said bolt by the suitably-mounted lever 13, connected with the head end of the longitudinally-disposed rod 14, said rod being connected at a point beyond the lever in a manner hereinafter described. By drawing the rod 14 to the right the effective portion of the latch 12 will be lifted in order to permit the spring-actuated bolt 11 to be instantly thrust or shot out by the force of its spring into operative engagement with the pulley 9 in order to operatively connect said pulley with the shaft 5 and naturally to result in the rotation of the shaft. The working end of the detent or latch 12 fits a peripheral groove in the clutch-sleeve 10, where it can engage the bolt 11 when said sleeve has made practically a full turn, in order that when the said full turn is wholly completed the bolt will be disengaged from the pulley to stop the rotation of the shaft.

We have described in a general way certain old mechanisms, which are more fully set forth in a contemporaneously-pending application filed December 28, 1904, Serial No. 238,683. It might be stated at this point that the rod 14 is drawn toward the right to effect the coupling of the pulley 9 with the shaft 5 by the movement of the wire; but as to this further description will hereinafter follow.

The wire after it leaves the straightening device 6 passes in contact with the upper sides of certain fixed die members, each designated by 15. There are several of these fixed or lower die members 15 represented in Fig. 1, illustrative of the organized machine. They are also clearly represented in Figs. 8 to 10, inclusive, and Fig. 16.

The respective die members 15 are rigidly carried by the bases 16 of standards 17, disposed vertically above the bed 2 of the machine. The standards 17, which, as will be hereinafter apparent, carry the upper die members coöperative with the die members 15, respectively, are adjustable longitudinally of the machine in order to effect variations in distance between the crimps, and for this purpose the bases 16 may be mounted for sliding movement along the upper side of the bed 2. The bases are represented (see particularly Fig. 4, for example) as having screws 18 on their under sides, the shanks of the screws passing through perforations in the cross-bars 19, the opposite ends of which are adapted to engage suitably-positioned flanges, as 20, within the hollow or chambered bed 2. By loosening up the screws the standards may be adjusted, and when in their desired relations can be thus maintained by the action of the screws.

Each of the lower or fixed die members 15 is rigidly united to a standard 17 and rests on a base 16 of the coöperating standard.

The upper die members are each designated by 21 and are adjustably united in some convenient way with the lower ends of the slides 22 on the front faces of the latter. The slides 22 are carried for vertical reciprocation in suitable ways on the standards 17 and are normally held elevated by coiled pull-springs, as 23, connected to the respective slides and standards. When the slides are elevated, their upper ends or antifriction-rolls, as 24, thereon engage the ineffective portions of the peripheries of cams, as 25, splined to the shaft 5, which, it will be remembered, is given intermittently a full or complete rotation. It naturally follows that each cam takes the same motion, and during the rotation of a cam the effective portion thereof presses a slide 22 downward, so that the die member 21, carried by said slide, can coöperate with a coöperating die member 15 to form a crimp in the wire. The effective portions of the cams 25 are so related that the cams operate in sequence, and when the wire or blank is under the action of the die mechanisms it is drawn oppositely, the blank being cut from the leading portion of the wire, as previously stated herein.

The die mechanisms, to which reference has been made in a general way, will be described more in detail. The leading end of the wire after it leaves the feed-rolls enters a guide-tube, as 26, and passes the cutting and bending mechanism, then along the upper sides of the several lower die members, although there may be only one of the latter, and finally enters a notch 27 in the block 28, supported on the bed 2 just beyond and in comparative proximity to the final die mechanism. When the extreme forward end of the wire enters the notch, it strikes a bolt, as 29, (see, for example, Figs. 8 and 9,) housed within said block 28 and normally held in its working or horizontal position by a leaf-spring, as 30. The rear end of the bolt 29 engages the suitably-mounted rock-lever 31, connected at its upper end with the rod 14, to which reference has hereinbefore been made. The normal position of the parts is represented in Fig. 8, the wire in said figure being illustrated as moving toward the right in said figure. On the slight advance movement of the wire the bolt 29 is thrust toward the right in said figure, thereby moving the lever 31 in a corresponding direction, the same applying with respect to the rod 14 in order to effect the release of the spring-controlled bolt 11 in the clutch-sleeve 10, whereby said bolt will be caused to automatically engage the driving-pulley 9 to operatively connect the latter with the shaft 5. The ini-

tial operation of the machine after the shaft starts to rotate is the severance of the forward end of the wire to form a blank, and the means shown for accomplishing this result involves a cutter, (designated in a general way by 32 and represented in detail in Fig. 6 and also shown in a number of the other figures—for example, Figs. 8 to 12, inclusive.)

The forward portion of the stock during the formation of the crimps therein is maintained in the notch 27 by a detent, as 33, of angular form, the longer arm of which is supported for rocking movement by suitable bearings upon the block 28. The lower arm of the detent 33 has a notch which registers with that in the block 28 to form a guide-passage for the extreme advance end of the wire. The detent 33, which is of the gravity type, is normally maintained against movement by a gravity-latch, as 34, pivoted at one end to one of the bearings which carries the detent 33 and shouldered between its ends to engage the detent below the center of motion of the latter. The latch 34, as will hereinafter appear, is elevated in order to free the detent and effect the ejectment from the crimping mechanism of the crimped and finished product.

As previously stated, the cutting mechanism involves a cutting member, as 32, the same being substantially of cylindrical form and being supported for turning and endwise movement by a boxing, as 35, supported on the framework of the machine. On the extreme forward end of the cutting member 32 is a segment 36, having one of its edges sharpened to produce a cutting edge, the sharpened portion being at the left in Fig. 8. The segment, the outer surface of which is concentric with the forward reduced portion of the cylindrical cutting member 32, is given a partial rotation forward and then backward, being adapted on its forward movement to cut through or snip off a predetermined length of wire. The said forward end of said cutting member turns in a transverse bore in the block 37, which transverse bore opens into a longitudinal bore through which the wire is fed, the place at which the two bores intersect being so shaped as to produce an edge which coöperates with that of the cutting member 32 in severing the desired length of wire. In Fig. 8 the segment is illustrated as being above the wire, the latter being shown by the arrow in the same figure as moving toward the right in said figure.

Extending longitudinally through the cutting member 32 is a pin or elongated spindle 38, which extends beyond the opposite ends of said cutting member. Only a short length of the pin or spindle extends beyond the forward end of the cutting member, so as to present a projection around which the cut end of the wire is adapted to be bent by the action of the segment 36.

The part 32 in addition to serving as a cutting member also serves, with the pin or spindle, as a hook-forming means.

The block 28 is provided with a cylindrical member 39, a duplicate in construction of the part 32, except that the bending-segment 40 of said cylindrical part 39 has no cutting edge. The bending member 39 has associated therewith a pin or spindle 41, constructed and operating exactly like the pin 38. The segments 36 and 40 bend the free ends of the wire-blank around the respective concentric pins 38 and 41 after the said wire has been cut by the action of the cutting portion of the segment 36. After the shaft is thrown into action the first thing that takes place is, as previously set forth, the severance of the advance end of the wire, and this is accomplished by the cutting edge of the segment 36.

The operation of the parts 32 and 39 and their pins 38 and 41 being identical and the same applying to the operating mechanism therefor, we deem it necessary to describe the construction and action of simply one of the operating mechanisms and associated parts, and the same are fully represented in Fig. 6, for example. Rotative with the shaft 5 is a peripherally-grooved cam, as 42, the peripheral groove of which has a straight portion and a substantially V portion, the branches of which V portion merge into such straight portion, the former constituting the effective part of said cam 42 and serving through certain intermediate devices to bring about a back-and-forth motion of the cutting member 32. A lever 43 is fulcrumed between its ends on the standard 44, rising from the upper side of the bed 2, the upper end of the lever having a projection situated in the groove of the cam 42 and normally located at the apex of the V portion thereof. The lower end of said lever is connected by a link 45 with the rack-bar 46, extending through a longitudinal opening in the boxing 35, and the teeth of which are adapted to mesh with a pinion 47, feathered on the cutting member 32. The cam 42 when it rotates under the action of the shaft 5 causes the projection on the upper end of the locking lever 43 to ride out of the V portion of the peripheral slot and into the straight portion thereof, and during this motion the segment 36 through the intermediate parts moves from the position shown in Fig. 8 to that indicated in Fig. 9, in which position it remains until the cam has made practically a complete rotation or until said projection enters the other branch of the said V portion, at which time the lever is returned by the cam to its primary position, a reverse motion being naturally applied to the cutting member 32.

It will be assumed that the shaft 5 has been started, as hereinbefore described, and that the cam 42 has commenced to rotate. When

it rotates, it will be understood that the rocking lever 43 is operated in such manner as to draw the rack-bar 46 toward the left in Fig. 6 and to rotate the pinion 47, and hence the cutting member 32, to cause the segment to travel from the position shown in Fig. 8 to that represented by Fig. 9, as before described. On the opposite motion of the lever the cutting member through the intermediate parts will be returned to its original position, or that shown in Fig. 8, for example. When the segment 36 moves from the position shown in Fig. 8 to that represented in Fig. 9, it first of all cuts through the wire, subsequent to which its flat inner face or the effective bending portion thereof curls the cut end of the blank around the pin 38. While the part 32 is being given its advance partial rotation the same motion is taking place with respect to the part 39, so that the segment 40, which rotates oppositely to the segment 36, can by its flat face bend the right free end of the blank around the pin 41.

It is necessary by the organization described to stop the feed of the wire during the cutting, crimping, and ejecting operations, and this result we secure by imparting an endwise movement to the cutting member 32 in order to bring the body thereof in such position as to close the outlet of the longitudinal bore of the block 37. Upon the said cutting member 32 at a suitable place is a stud 48, shown as an antifriction-roll, adapted to coöperate with the beveled face of a cam member 49, suitably rigidly attached to the forward side of the boxing 35. When the part 32 was rotated to bring about the severance of the wire and the bending of the cut end about a pin, the stud, projection, or antifriction-roll 48 was caused to ride against the beveled face of the cam 49, so as to impart an advance movement to said part 32 and to bring its imperforate portion opposite or into coincidence with the outlet of the longitudinal bore of the block 37 and so that the advance end of the major portion of the wire will strike against the said imperforate portion to arrest the further feed of the wire. The forward motion of the cutting member 32 is in opposition to the coiled protractile or push spring 50, surrounding the rear portion of said cutting member and bearing against the boxing 35 and also against a suitable stop on said cutting member. On the forward movement of the cutting member to effect the arrest in feed of the wire the spring 50 is compressed, whereby on the return rotative movement of said cutting member the latter may be retracted by the expanding-spring, the operation being concluded when the roll 48 passes out of contact with the operative surface of the cam 49.

As the wire when crimped is drawn toward the intermediate portion from its opposite or hooked ends, it is essential that the pins prior to the crimping operation should be freed from the said hooked ends. This result is accomplished by the rearward endwise movement of the pins. We will describe, of course, only one of the pins and its operating and adjunctive devices, as the same description applies to the other parts. The rear end of the pin 38 (see Fig. 6) extends through a suitable guide perforation in a lateral extension on the bracket 51, the rear portion of the pin being encircled by a coiled push-spring, as 52, engaging one of the check-nuts, between which one arm of the suitably-mounted elbow-lever 53 is mounted, said arm having a perforation to receive the pin or rod 38. The spring 52, it will therefore be apparent, by engaging one of the check-nuts presses the pin 38 normally forward, so as to maintain the extreme front end in position to receive the wire to be bent about the same by the segment 36. The free arm of the elbow-lever 53 fits in an aperture 54 in the under side of an actuator 55, adjustably connected at one end with the rack-bar 46, from which it will be apparent that said actuator or bar 55 partakes of the movement of the rack-bar. The formation of the aperture 54 produces two shoulders on the under side of the actuator 55, between which the free arm of the angle-lever 53 is normally disposed. The shoulder on the right in Fig. 7 is normally out of contact with said free arm. When the rack-bar 46 is moved toward the left in Fig. 6 to effect the rotation of the member 32 in the manner hereinbefore described, the actuator or bar 55 is moved in a corresponding direction, and just after the hook is formed in the left end of the wire the shoulder on the right on the under side of said actuator strikes the free arm of the angle-lever 53 in order to thrust the pin 38 rearward, during which motion the spring 52 is compressed and the forward end of the said pin is moved entirely out of the path of the wire or freed wholly from the hook. This operation is repeated, as will be understood, near the opposite end of the machine. On the return movement of the rack-bar the shoulder on the right of the actuator 55 moves away from the free arm of the lever 53, so that the spring 52 can return the pin 38 to its primary position and to receive the free end of a wire to be bent thereabout. Should the spring fail to act in returning the pin to its original position, such result will be brought about by the shoulder on the left of the actuator 55 acting against the lever 53. It should be stated that when the segment 40 moves from the position shown in Fig. 8 to that represented in Fig. 9 it engages and then rides off the bolt 29, during its contact imparting a downward swinging movement to said bolt. As soon as the segment passes off the bolt the latter is promptly returned to its original position by the spring 30.

In connection with the die mechanisms we provide a device for aiding in guiding the wire, which is subsequently effective for effecting the ejectment from the die mechanisms or crimping means of the finished product. As a matter of fact in practice we provide several of these devices, one of them being shown in detail in Figs. 13 and 14. We will now describe in detail one of said devices, such description applying to the others, as they are the same in construction.

Within the bed 2 is mounted a rock-shaft 60, to which are rigidly united in some suitable way the hubs of the swinging arms 61. (See Fig. 4.) Referring now to Figs. 13 and 14, it will be seen that the upper end of the rock-arm 61 is enlarged to present a head, and in the upper side of the enlargement is formed a recess 62, which coöperates with a recess 63 on the gravity-latch 64, supported by the framework of the machine and independently of the swinging arm 61. The two recesses 62 and 63 normally mate, as indicated in Fig. 13, to form a guide-passage for the wire, and through which said wire is threaded as it is fed toward the bole 29. In the upper side or head portion of the swinging member 61 a concavity 65 is formed, which normally receives a convex portion 66 on the under side of the pivoted gravity-latch 64, the relation in question being maintained by the automatic action of the latch. During such relation the two recesses 62 and 63 mate to form the passage mentioned. When the recesses do mate, the wire is prevented from lateral movement by the walls of the passage formed by such recesses. In other words, the swinging member 61 and coöperating latch 64 act conjointly to maintain the wire against movement and to also prevent lateral motion of the cut blank.

On the upper side of the head portion of the swinging member is located an upright projection 66′, which fits within a longitudinal slot in the superposed latch 64, whereby on the motion of the swinging member relative to the latch the former will be prevented from sidewise action. There is one swinging arm or member 61 and coöperating latch 64 between each pair of die mechanisms, although this is not essential.

The wire is fed toward the bolt 29 and in its passage toward said bolt passes through the passages formed by the complemental recesses 62 and 63, and after the shaft 5 is started in action the initial thing that takes place is the severance of the wire into a blank. Then the ends of the blank are shaped to present hooks, following which the die mechanisms are rendered successively effective to form crimps of the character set forth at predetermined intervals in the blank. The cams 25 for effecting the successive action of the blocks or slides 22, which carry the upper die members 21, act in succession. The upper die members 21 each includes on its lower edge several salient portions, the intermediate one of which is more prominent than the side ones, while the lower die members are of reverse construction. It will be apparent that when an upper die member 21 is pressed downward against the wire imposed upon the lower or fixed die member 15 a crimp of the kind shown in Fig. 17 and also in Fig. 10 will be formed. The first cam 25 on the left initially acts to press the coöperating upper die member downward, following which the remaining cams 25 operate in succession. After the working portion of a cam 25 passes from out of contact with an antifriction-roller 24 the coöperating die member 21 is returned to its original position by the force of a spring 23.

To the shaft 60 and at suitable points thereon are rigidly joined rock-arms, as 70, to the upper ends of which the links 71 are jointed, the opposite ends of said links being connected to levers, as 72, fulcrumed on the framework of the machine, and the upper ends of which normally engage the ineffective or release portions of cams, as 73, splined or otherwise connected to the shaft 5.

The working portions of the two cams 73 are alined longitudinally of the machine and are adapted to engage the upper ends of the levers 72 immediately after the last slide 22 has been returned to its original position and naturally after the formation of the final crimp in the cut length of wire. When the final crimp is formed, the two cams 73 or the effective portions thereof simultaneously operate the levers 72, so as to impart a forward movement to the lower arms of said levers and naturally a corresponding movement to the arms 70, and hence the swinging members 61. When the working portions of the two cams pass free of the levers 72, the latter are returned to their original positions by means of springs, as 74, connected to the rock-arms 70 and also to the framing of the machine interiorly of the bed 2. On the forward movement of the swinging members 61 they coact to effect the ejectment of the crimped stock away from the crimping mechanisms or, as they are in the present case, a series of correlated dies. On the action of the levers 72 in unison by the cams 73 the swinging members 61 are moved forward, which would be toward the left in Fig. 4 and toward the right in Figs. 13 and 14. In the last-mentioned figure we have shown the member 61 by dotted lines as being near its extreme forward position, and it might be stated that the forward movement of the said swinging member is an accelerated one, the working portions of the cams 73 being so shaped as to secure such motion. On the forward motion of the several members 61, which occurs, of course, simultaneously, the latches 64 are caused to be elevated by the riding out of the convex portions or rounded

projections 66 from the concavities or seats 65 in the respective swinging members 61, so that the latches are elevated sufficiently to free them from the wire. The back walls of the recesses 62 then serve to impel the crimped stock forward in a quick manner, and, falling from the members 61, said stock drops into a cradle, as 75, suitably fastened to the forward side of the bed 2, and from which the crimped stock can be removed at intervals. On the return movement of the swinging member 61 free of the product the latches 64 drop simultaneously to their original positions, when the seats 65 come opposite the rounded projections 66.

The latch or controller 64 on the extreme right in Fig. 1 normally engages under the free portion of the latch 34, which latch, as will be remembered, normally prevents motion of the detent 33. When, therefore, said outermost latch 64 is elevated, it will elevate the latch 34, so as to free the latter from the detent 33, whereby the latter will release the extreme forward end of the finished product. When the detent 33 is rendered ineffective by the elevation of the latch 34, said extreme forward end of the product can be readily moved from out of the notch or recess 27.

From the outer end of the block 28 there is represented as extending a slotted projection 76, in the slot of which the upper end of the rock-lever 31 plays, the outward movement of said lever being controlled by the adjustable stop 77, shown as a set-screw tapped through the outer end of said projection 76.

Briefly set forth, the operation of the machine constructed as hereinbefore described is as follows: The wire is fed positively into the machine, the leading end thereof throwing the shaft 5 into action, as hereinbefore described. Upon the cutting off of a predetermined length of wire by the cutting mechanism set in motion by the shaft the ends of the wire are first bent to form hooks, after which the wire is crimped at predetermined points in its length. After the wire is crimped it is ejected from the crimping or die mechanisms into a suitable receiver.

We desire to state that we do not limit ourselves to the construction hereinbefore described, and shown in detail in the accompanying drawings, for the construction may be radically modified within the scope of our claims. We have used herein certain terms and desire it to be distinctly understood that said terms are in their generic senses with a view of covering equivalent parts.

Having thus described our invention, what we claim is—

1. A wire-working machine having means for feeding the wire, and a member arranged to cut off a predetermined length of wire to form a blank, to also bend the wire into a hook, and to also arrest the feed of the wire back of the blank during the hook-forming operation.

2. A wire-working machine having means for forming hooks in the opposite ends of a wire blank, and crimping mechanism located between the hook-forming mechanism and consisting of a relatively stationary die member, and a coöperating movable die member, the opposite faces of the die members having salient portions, and the stationary member constituting a support for the blank, and means for operating the movable die member whereby it, and the coöperating die member, will form a crimp of compound curvature in the wire.

3. A wire-working machine having means for forming hooks in the opposite ends of a wire blank, a plurality of relatively stationary die members to support the blank, a corresponding number of movable die members coöperative with the relatively stationary die members, the coacting die members having opposing faces provided with salient portions, and means for operating the movable die members in succession after the formation of the hooks in the blank, to form a succession of crimps of compound curvature in the blank.

4. A wire-working machine having means for feeding the wire, and a member having a cutting part arranged to sever a predetermined length of wire to constitute a blank, said member being capable of independent movement to arrest the feed of the wire.

5. A wire-working machine having means for feeding the wire, a member having a cutting part arranged for movement to cause the cutting part to sever a predetermined length of wire to constitute a blank, said member being capable of independent movement to arrest the feed of the wire, and means for forming a crimp in the cut wire.

6. A wire-working machine having means for feeding the wire, a member to perform the following three operations, to wit: cutting the wire into a predetermined length to constitute a blank, arresting the feed of the wire back of the blank, and forming a hook in the rear end of the cut blank, and means for forming crimps in the wire.

7. The combination with two coöperating members, each having a bending portion and a movable part, the bending portion being adapted on the motion of the movable member to bend the opposite ends of a wire blank around the movable parts, mechanism for automatically moving the movable parts out of contact with the wire, and crimp-forming mechanism to act upon the wire between the hooks.

8. A wire-working machine having two turnable members, each provided with a bending-segment, and a movable pin extending through and normally beyond one end

thereof, said turnable members being adapted to bend the opposite ends of a wire blank around the projecting ends of the pins to form hooks in the opposite ends of said wire, means for moving the pins endwise to carry them out of contact with the wire, and crimp-forming mechanism to act upon the wire between the hooks.

9. A wire-working machine having means for feeding the wire, a member having a cutting part and arranged for movement in one direction to cause the cutting part to sever a predetermined length of wire to constitute a blank and for movement in a different direction to arrest the feed of the wire.

10. In a wire-working machine a member having a cutting part and arranged for turning movement to cause the cutting part to sever a predetermined length of wire to constitute a blank and also arranged for endwise movement to arrest the feed of the wire.

11. A wire-working machine having a turnable member provided with a bending-segment on one end, a pin extending through said turnable member and projecting beyond that end thereof which is provided with said segment, said segment being arranged to bend the end of a wire about the projecting end of the pin on the turning movement of said member, and the pin being endwise movable to carry it free of the wire.

12. A wire-working machine having a turnable member provided with a bending-segment on one end, a pin extending through said turnable member and projecting beyond that end thereof which is provided with the segment, said segment having a cutting edge and being arranged to bend the end of a wire about the projecting end of the pin on the turning movement of said member.

13. A wire-working machine having a turnable member provided with a bending-segment on one end, a pin extending through said turnable member and projecting beyond that end thereof which is provided with the segment, said segment having a cutting edge and being arranged to bend the end of a wire about the projecting end of the pin on the turning movement of said member, and the pin being endwise movable to carry it free of the wire.

14. A wire-working machine having wire-feeding means, and a turnable member provided with a segment on one end, a pin extending through said turnable member and projecting beyond that end thereof which is provided with said segment, said segment being arranged to bend the end of the wire about the projecting end of the pin on the turning movement of said member and the pin being endwise movable to carry it free of the wire, and means for imparting an endwise movement to said turnable member to bring it in position to arrest the feed of the wire.

15. A wire-working machine having a turnable member provided with a bending-segment on one end, a pin extending through said turnable member and projecting beyond that end thereof which is provided with said segment, said segment being arranged to bend the end of a wire about the projecting end of the pin on the turning movement of said member, yieldable means for normally maintaining the pin in the relation set forth, and mechanism for positively imparting an endwise movement to the pin in opposition to said yieldable means to carry the pin free of the wire.

16. A wire-working machine having a turnable member provided with a bending-segment on one end, a pin extending through said turnable member and projecting beyond that end thereof which is provided with said segment, said segment being arranged to bend the end of a wire about the projecting end of the pin on the turning movement of said member, a spring for normally maintaining the pin in the relation set forth, means for positively operating the pin in opposition to said spring to carry the pin free of the wire, a pinion connected with the turnable member, a rack-bar the teeth of which mesh with the pinion, and means for reciprocating the rack-bar.

17. A wire-working machine having crimp-forming mechanism to act upon the wire blank, and two independently-supported and recessed members, the recesses of which mate to form a wire-guiding passage, and one of the members being operable by the other to effect the release of the wire, and mechanism for positively operating said other member to move the wire away from the companion member and after the formation of a crimp in the wire.

18. A wire-working machine having two independently-supported and recessed members, the recesses of which mate to form a wire-guiding passage, and one of said members being operable by the other to effect the release of the wire, and said other member being also operable to move the wire away from the companion member.

19. A wire-working machine having crimping mechanism, two independently-supported and recessed members, the recesses of which mate to form a wire-guiding passage, means for feeding the wire to the crimping mechanism and through said passage, one of said movably-mounted members being operable by the other to effect the release of the wire, and said other member being arranged to eject the crimped wire away from the crimping mechanism.

20. A wire-working machine having a recessed swinging member, and an independently-supported latch also recessed, the recesses in the two parts normally mating, said swinging member being adapted on its work-

ing movement to operate the latch in a direction to free the same from the wire and to also cause the movement of said wire.

21. A wire-working machine having a swinging member provided with a concavity and a recess in its head, and a latch supported independently of said swinging member and provided with a convexity normally to enter said concavity and with a recess to mate with the other recess to form a wire-guiding passage, said swinging member being adapted on its working movement to operate the latch in a direction to free the wire and to also move the wire away from the latch.

22. A wire-working machine having means for feeding the wire and for cutting the same into a predetermined length and for forming hooks in the opposite ends of the cut length, mechanism for forming a succession of crimps in the hook-formed wire, a plurality of coöperating independently-supported and recessed members, the recesses of which mate to form a wire-guiding passage, and one member in each case being operable by the other to effect the release of the wire, a notched part to receive the forward end of the wire, a notched detent, the notch of which coöperates with the notch in the said part to hold said front end of the wire, and a latch to normally maintain the detent in its operative position, said latch being operable by one of said movably-mounted members to cause the release of the detent.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

ORLA H. WATKINS.
CHARLES F. SKELLENGER.

Witnesses:
ANNA M. COOPER,
ANNA JANSERN.