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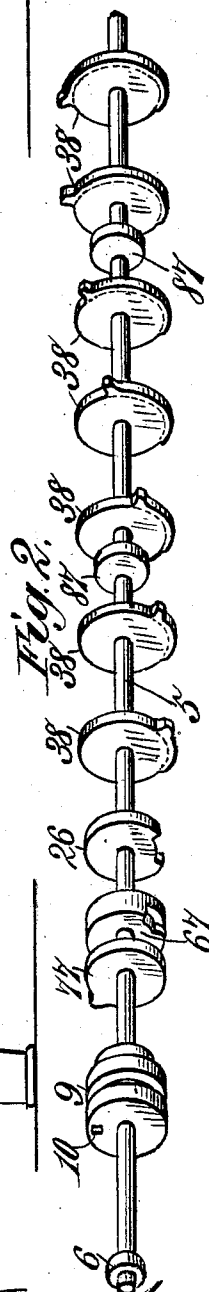
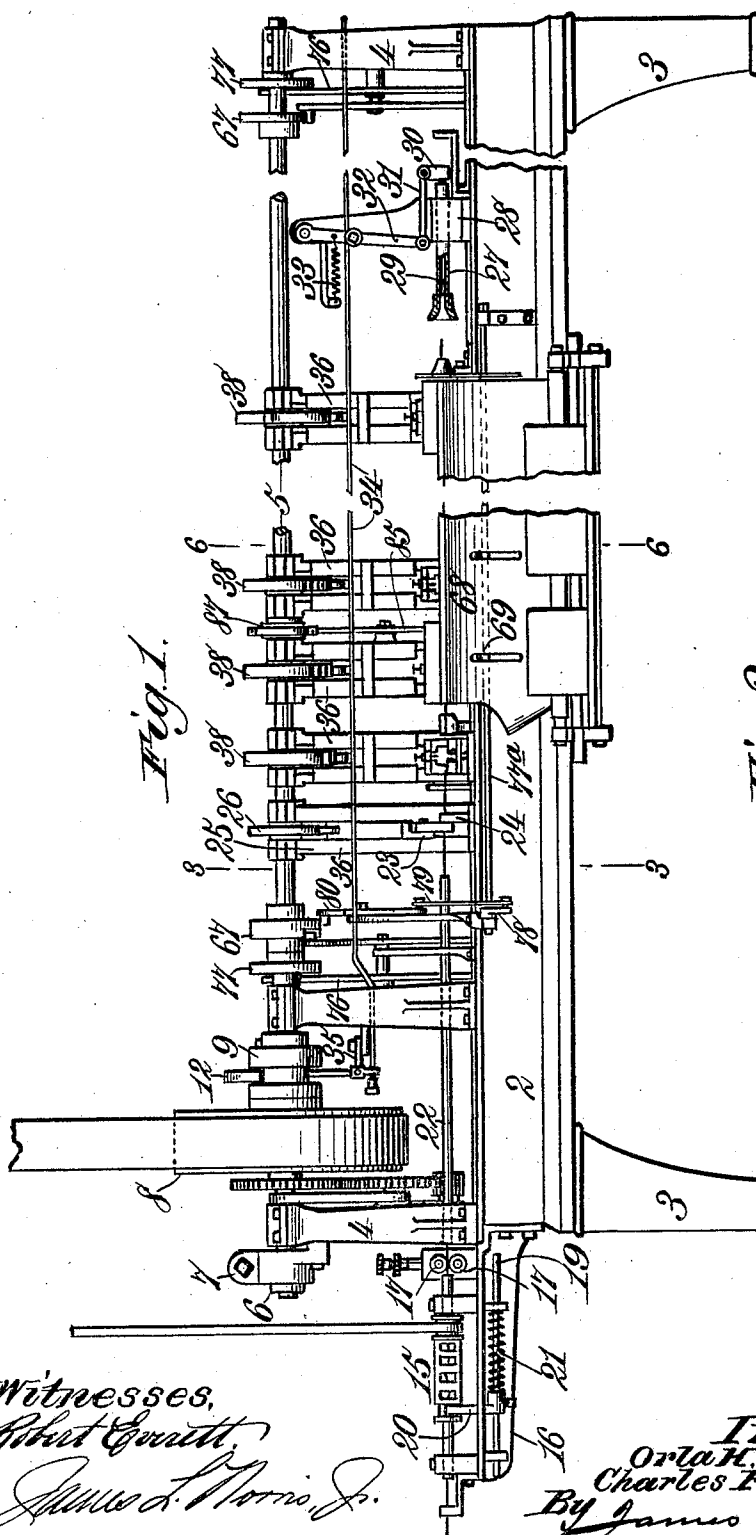
PATENTED MAY 1, 1906.

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

WIRE WORKING MACHINE.

APPLICATION FILED DEC. 28, 1904.

5 SHEETS—SHEET 1.



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16
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6 SHEETS—SHEET 2.

Fig. 3.

Fig. 4.

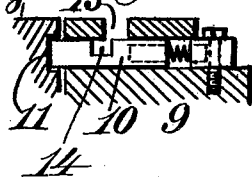
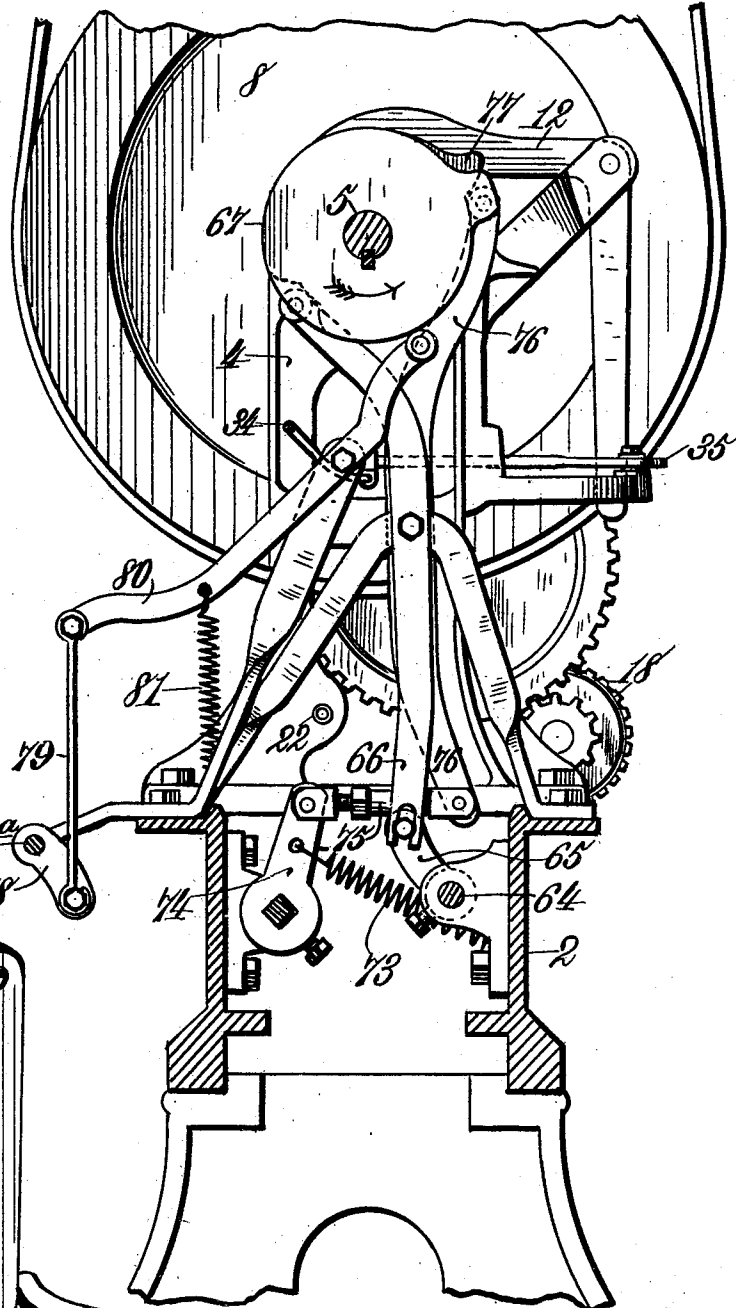
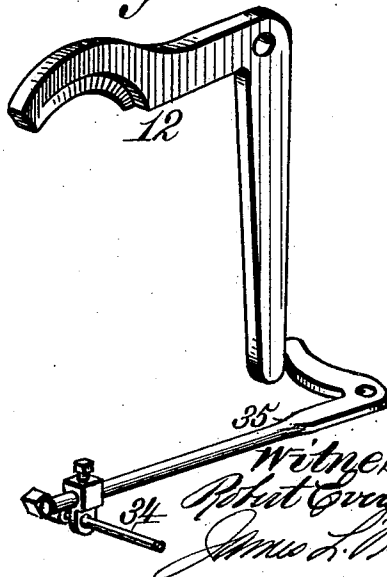


Fig. 5.



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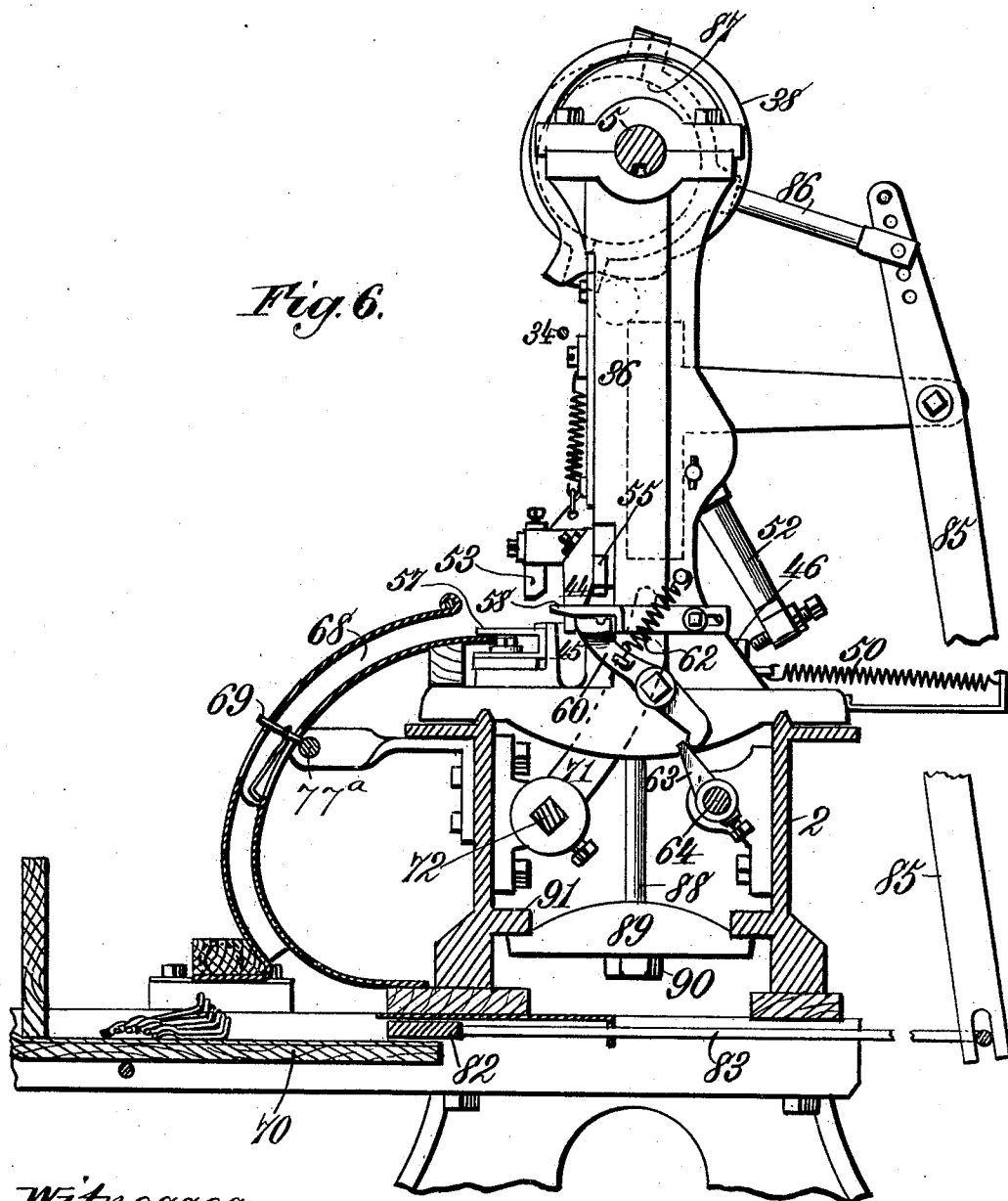
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WIRE WORKING MACHINE.

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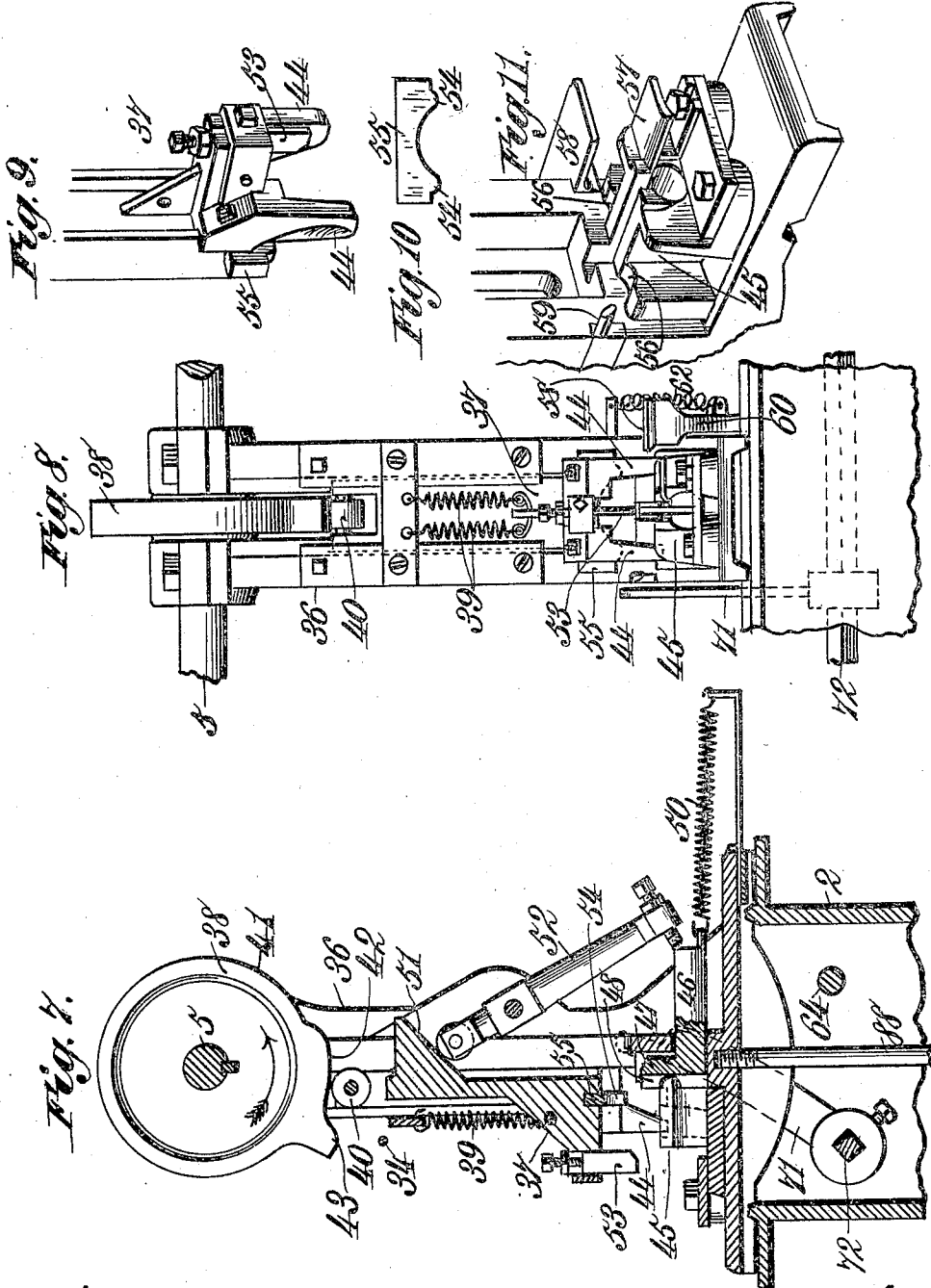
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WIRE WORKING MACHINE.

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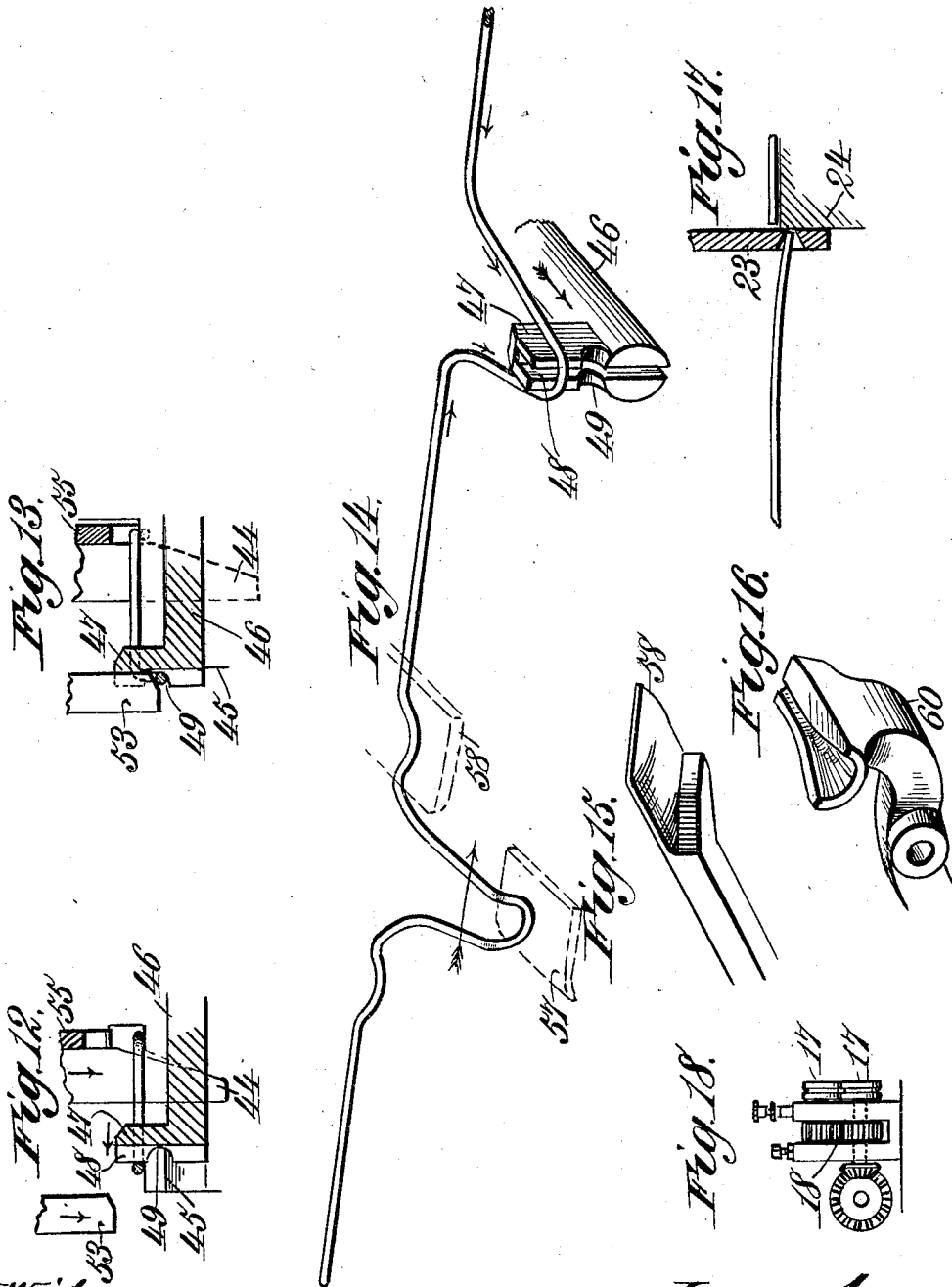
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UNITED STATES PATENT OFFICE.

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WIRE-WORKING MACHINE.

No. 819,479.

Specification of Letters Patent.

Patented May 1, 1906.

Application filed December 28, 1904. Serial No. 238,683.

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.

While the latter within the scope of our invention may be employed for making wire into various shapes, we have illustrated in the accompanying drawings, forming a part of this specification, an organization of the machine primarily adapted for making stay-wires utilized in the manufacture of springs for beds and other articles of furniture. In that form of stay-wire which we make the same involves a plurality of longitudinally-disposed crimps; and it is the principal object of the invention to form these crimps in the wire in a rapid manner and with an accuracy equaling hand operation. It might be stated that the term "crimp" is used in its broad sense.

The machine possesses other objects and advantages, which will be set forth in the following description, while the novelty of the invention will be embraced in the claims succeeding said description.

Referring to the drawings, Figure 1 is a front elevation of a wire-working machine embodying our invention. Fig. 2 is a perspective view of a shaft shown in the preceding figure and certain cams and other devices carried thereby. Fig. 3 is a vertical sectional elevation, the section being taken on the line 3 3 of Fig. 1. Fig. 4 is a detail view, in sectional elevation, of the working parts of a one-revolution clutch. Fig. 5 is a perspective view of a controlling member for said clutch and certain cooperating devices. Fig. 6 is a sectional elevation, the section being taken on the line 6 6 of Fig. 1. Fig. 7 is a transverse sectional elevation, the section being taken through the die mechanism. Fig. 8 is a front elevation of the parts shown in Fig. 7. Fig. 9 is a perspective view of the lower portion of the upper die shown in Figs. 7 and 8. Fig. 10 is an elevation of a die member carried by said upper die. Fig. 11 is a perspective view of the lower die member and certain adjacent parts. Figs. 12 and 13

are sectional elevations showing certain of the operations performed thereby. Fig. 14 is a perspective view of a portion of the wire and showing a crimp formed therein, a looping device, and certain means for holding the crimps against lateral motion, the means being shown in dotted lines. Figs. 15 and 16 are details in perspective of certain holding and guiding devices. Fig. 17 is a section of the cutting means. Fig. 18 is a detail of certain gearing of the wire-feed.

Like characters refer to like parts throughout the several figures.

The machine represented in the drawings is especially adapted for the formation of crimps in a blank to produce a stay wire or rod, each crimp consisting of a looped portion having a lateral bend at its free end and bends laterally deflected formed in the body of the blank. These crimps should be equidistantly disposed, and this equidistant disposition can be accomplished by the improved machine and in such a manner that the blank is not subjected to any endwise strain. The blank, as will hereinafter appear, is free for longitudinal movement from opposite directions toward the intermediate portion thereof, and the crimps are formed in the blank in the present instance in succession, so as to avoid pulling strain upon the blank previously cut from suitable stock.

The machine-framing may be of any suitable character. That represented includes a bed 2, from which the legs 3 depend, said bed, as will hereinafter appear, being in the nature of a main frame, and it and the legs may be constructed of any suitable material or size and assembled in any desirable way.

From the opposite ends of the bed 2 duplicate standards or uprights 4 rise, said standards being connected to the bed in any desirable way and serving as a convenient support for the main shaft 5, extending practically the length of the bed of the machine.

The shaft 5, as will hereinafter appear, carries certain cam and other devices for intermittently operating the die and other mechanisms and is intermittently rotated, being given each time it is thrown into operation one complete turn, and during the single rotation of said shaft a length of wire to form a blank is cut from the stock, has crimps formed at regular intervals therein, and is otherwise operated upon. The shaft 5 is

thrown into action by the operation of the advancing wire. As stated, the shaft 5 on each of its intermittent operations makes one full turn, and to prevent overthrow of the same, suitable friction stopping means are provided, the same including a sleeve, as 6, suitably fastened to the shaft, as represented in Fig. 2, at the extreme left end thereof and rotative in a split bracket 7, connected with the standard 4 on the left. The engagement of the periphery of the sleeve 6 with the inner surface of the bracket 7 is a frictional one, so that when the shaft has made one full turn under the action of driving mechanism and when the driving mechanism is thrown out of connection with the shaft the friction stopping means will be effective for instantly stopping the shaft when it has made one full turn in order that certain operating devices will not be carried beyond their normal positions. The friction-shaft stopping means is a common one in a number of arts, and for this purpose we have not deemed a detailed illustration of the same necessary. Other means may be substituted for said friction stopping means to subserve the same function.

Upon the shaft 5 and loosely carried thereby is a driver, represented as a pulley 8, operated continuously by means of suitable belting from some convenient form of motor. (Not illustrated.) Suitably fixed to the shaft 5 is a clutch member, as 9, provided with a transverse passage near its periphery in which the spring-actuated bolt 10 operates, the working end of the bolt being adapted to engage in a seat or depression 11 in the pulley 8 when said bolt is automatically released. Normally the bolt is held retracted by a controlling device or detent, as 12, represented as an angle-lever (see Fig. 5) suitably supported by the standard 4 at the left. The effective end of the detent 12 is arched, the arched portion being beveled on its under side to enter a peripheral slot 13 in the clutch member 9 and also enter a notch 14 in the spring-actuated bolt 10 to hold said bolt retracted and out of the seat 11 in the pulley 8, whereby the clutch member will be maintained out of operative relation with the pulley.

The upper branch of the detent 12 is of sufficient weight to normally maintain the same in its operative relation—that is, to hold the coupling-bolt 10 retracted. When, however, the weighted or working arm of the detent is lifted, the spring-actuated bolt 10 will be released, so that when the seat 11 on the rotation of the pulley 8 registers or comes opposite the bolt the spring of the latter can thrust the working end of said bolt into said seat 11 to couple the clutch and pulley to thereby throw the shaft 5 into action. When the detent is released, it instantly returns to its normal position, so that when the clutch

member has made practically a full turn the working end of the detent can fall through the slot 13 and notch 14 in order that the beveled face thereon can draw the bolt 10 back to disengage it from the pulley 8. It is at this point that the friction stopping means hereinbefore described suddenly arrests the rotation of the main shaft 5.

The wire is led forward through the machine from a suitable reel (not shown) and in its progress travels through a straightening device, denoted in a general way by 15. As said straightening device is of the ordinary construction, a detailed description of the same is not deemed necessary. The tubular portions of the straightening device are supported for longitudinal movement by suitable bearings on the bracket 16, bolted or otherwise suitably fastened to the head end of the machine and extending forward therefrom. It will be evident therefore, that the straightening device is capable of longitudinal movement relative to the machine. The wire after it emerges from the straightening device 15 passes between superposed feed-rolls, each denoted by 17 and supported by suitable means on the bracket 16. The upper feed-roll is positively driven in any suitable way from the driver 8—for example, through the intervention of interposed gearing, denoted in a general way by 18. (See, for example, Fig. 18.) The prime gear of the series is rigidly connected in any desirable way with the pulley or driver 18, while the final gear of the train is connected in some suitable way with the said upper feed-roll. The two feed-rolls apply a friction-feed to the stock or wire between the same, so that when the said stock or wire is interrupted in its progress, as will hereinafter appear, said friction-rolls may rotate idly.

Below the straightening device 15 and suitably supported by the bracket 16 is a horizontally-disposed rod 19, extending longitudinally of said bracket and rigidly carrying at one end an upright arm 20, the upper end of which is fitted in a peripheral groove of the wire-straightening member 15. The rod 19 is surrounded by a coiled push-spring 21, acting at one end against the arm 20 and at the other against a suitable fixture on the bracket. As will hereinafter be apparent, the feed of the wire or stock is momentarily arrested, and should the straightening device be held at rest during such period it would act upon the same surface of the wire, the resulting friction causing the undue heating of the wire or, as it is known, "burning." To prevent burning of the wire, a movement longitudinally thereof is imparted to the straightening device by the spring 21. As soon as the feed of the wire is stopped the said spring, by acting against the arm 20, and the latter in turn acting against the straightening device serves to push the latter toward the left in Fig. 1 to

avoid the possibility mentioned. As soon as the feed of the wire is commenced the wire, as it is advanced, acts to draw the straightening device 15 toward the right in Fig. 1 or toward its primary position. The wire after it passes the feed-rolls 17 traverses the guidetube 22, extending longitudinally of the bed 2 and suitably supported above the same. Leaving the tube the advance end of the wire is threaded through the eye or perforation in the upper member 23 of cutting mechanism, the lower member of said cutting mechanism being denoted by 24. (See Fig. 17, for example.) The lower cutting member 24 is supported upon the upper side of the bed 2 at a point just beyond the delivery end of the tube 22 toward the rear end of the machine, while the upper member of the cutting mechanism or knife proper is supported for vertical reciprocatory movement in suitable guides on the standard 25, rising from said bed. (See Fig. 1, for example.)

The cutting mechanism, composed of the upper and lower cutting members described and means for operating the cutting members to form blanks is of a kind familiar in the present art, and hence we do not deem it necessary to more fully illustrate the same than represented in Figs. 1 and 17. It might be stated that the cutting member 23 is carried by a suitable slide on the standard 25 and is upheld normally to maintain the eye or perforation thereof in the line of feed by a spring or springs, not illustrated, but substantially like those hereinafter described for normally maintaining the upper die members up. The upper end of the slide which carries the upper cutting member 23 normally fits in a peripheral notch in the cam-disk 26, suitably rigidly fastened to the shaft 5. The wire after being fed through the perforation or eye in the upper cutting member 23 is fed forward through the machine by the rolls and into the bell-shaped mouth of the tube 27, (see Fig. 1,) suitably supported by the standard 28 on the upper side of the base. The tube 27 houses a rod 29, the forward end of which is adapted for engagement by the leading end of the wire or stock, while the opposite end of said rod is furnished with an upright arm 30, connected to a link 31, which in turn is connected to the lower end of the oscillatory lever 32, fulcrumed at its upper end to the standard 28. Connected to said rocking lever 32 and also to a bracket extending forward from the said standard is a pull-spring 33, which normally maintains the rod 29 in its extreme forward position and to be engaged by the leading or advance end of the wire unwound from the reel and fed forward by the rolls 17.

Extending longitudinally of the machine and above the bed thereof is a rod 34, clamped near its rear end in some suitable way to the rocking lever 32. An angle-lever

35 (see Fig. 5) is connected in some suitable way with the extreme forward end of said rod 34, said angle-lever 35 being horizontally disposed and having branches of unequal length, the short branch of the angle-lever being adapted when the rod 34 is pulled toward the rear of the machine to engage the substantially vertical arm of the angular detent 12, so as to lift the horizontal arm of said detent and disengage it from the bolt 10, whereby the bolt can be thrust immediately to its effective position by the power of its governing-spring. It will therefore be apparent that when the leading or advancing end of the wire strikes the rod 29 and that on the slight movement of the wire under the influence of the feed-rolls 17 said rod will be thrust rearward by the action of the advancing wire, so as to swing the lever 32, and thereby the rod 34, through the intermediate parts rearward or toward the right in Fig. 1. As the rod 34 is thus operated it serves through the intermediate parts to elevate the working arm of the detent 12 in order to release the bolt 10 to throw the shaft 5 into action, as hereinbefore described. The instant that the shaft is thrown into action the cam 26 is caused to rotate, so as to cause the upper end of the slide to which the upper cutting member 23 is connected to ride out of the notch in the cam 26 in order to thrust said cutting member downward, so that the latter can cooperate with the cutting member 24 to cut off or sever a predetermined length of wire, which length is to constitute the blank and which is to be subsequently crimped at regular intervals between its ends. When the wire is crimped, it is drawn toward its center from opposite ends thereof, whereby the extreme right end of the blank will be carried out of engagement with the rod 29 in order to release said rod, and thereby the parts connected therewith, so that the latter can be returned to their primary positions by the action of the spring 33. When the rod 34 is moved toward the right under the action of said spring, the detent 12 will of course be released, so that the working arm thereof can drop to its original position in order to retract the bolt 10 when the clutch member 9 has made a full turn, as hereinbefore described. When the blank is cut off, under the action of the cutting members 23 and 24, the wire or stock is deflected downward by the cutting member 23 and against the solid portion of the cutting member 24, as shown in Fig. 17, so as to arrest momentarily the feed of the wire. When the feed of the wire is stopped, the blank will be crimped.

Rising from the upper side of the bed and suitably connected thereto are the standards 36, of any desirable number and through which the shaft 5 extends. As each standard and the parts carried thereby for forming a crimp is the same, a description of one

standard and the intermediate crimping mechanism will suffice for all, except to state, of course, that the crimps are successively formed, whereby no longitudinal strain will be applied to the blank or previously-cut length of wire. The crimp-forming mechanism is illustrated clearly by Figs. 7 to 14, inclusive.

Referring to Figs. 7 and 8, it will be seen that the standard 36 represented thereby carries an upper die member 37, adapted to be lowered by a cam 38, keyed or otherwise suitably fastened to the shaft 5. The direction of rotation of the shaft, and hence of the cam, is indicated in said Fig. 7 by the arrow placed on the cam. The upper die member 37, which is in the nature of a vertically-reciprocating slide, is normally upheld by pull-springs, as 39, connected therewith, and also to a suitable fixture on the standard 36, thus holding the antifriction-roll or other suitable projection 40 on the upper side of the die member against the surface of said cam. The cam has three portions 41, 42, and 43, respectively, on its periphery, serving as releasing, holding down, and thrusting down faces. The face 42 of the cam normally holds the die member 37 down in position to permit a portion thereof to cooperate with a looping element. The portion 43 serves to thrust the die member down to form certain bends in the wire. When the roll 40 passes off the cam-face 43, the springs 39 instantly elevate the die member 37, so as to carry the roll 40 against the releasing-face 41 of the cam.

On that side of the die member 37, which is in the foreground in Figs. 1 and 8 and at the left in Fig. 7, (see also Fig. 9,) two legs 44 depend, they being spaced apart a distance sufficient to permit the passage therebetween of a looping device and normally fitting in apertures in opposite sides of the lower die member 45, connected with the base 2 and standard 36 in any desirable way. It will be understood that the legs 44 are normally in the plane of movement of the working portion of a looping device. The wire is fed across the upper side of the back portion of the die member 45 between the legs 44 and the standards 36. The looping device (see, for example, Fig. 14, where it is best illustrated,) is in the nature of a horizontally-reciprocating bolt 46, having at its front end an upright head 47, said front end of the looping device having a vertical groove 48, intersected by a concavity or seat 49. The standard 36 and lower die member 45 are channeled for the passage back and forth in said channel of the looping device 46. The looping device 46 is held in its backward position by a spring, as 50. It might be stated that the way or channel in the lower die or block 45 and standard 36 is shaped to cross-sectionally agree with the head end of the looping mem-

ber, so as to prevent lateral movement of said looping member.

The lower ends of the depending legs 44 of the upper die member 37, as previously indicated, fit within the apertures in the opposite sides of the lower die member 45, while the head 47 of the looping device 46 normally fits within the rear part of the channel in the standard and lower die member, respectively, the rear end of the channel being closed, so that the rear wall thereof serves as a back-stop for said looping device.

When the shaft 5 is thrown into action in the manner hereinbefore indicated, the cam 38 will be rotated, and as it does rotate it thrusts the die member 37 downward through the intermediate parts, and on the initial movement of the cam the looping device 46 is advanced to form a loop in the wire.

On the back side of the upper die member 37 is a cam-face 51, adapted to cooperate with an antifriction-roll carried at the upper end of the rocking lever 52, fulcrumed on the standard 36, the free end of the rocking lever having an adjustable engagement by means of a screw with the back end of the body of the looping device 46. When the die member 37 is thrust downward under the action of the cam, the looping device 46 through the intermediate parts is advanced or is moved toward the left in Fig. 7, so as to move between the legs 44 and force a portion of the cut length of wire therebetween in order to form a loop in said wire, the length of which depends upon the amount of travel of the looping member. On the upward movement of the die member 37 the looping device 46 is instantly released, so that it can be drawn back by its spring 50. The upper die member 37 has on its fore side a depending loop-bending device 53, which toward the completion of the descending movement of said die member 37 is adapted to enter the vertical groove 48 in the advanced looping device 46 and to engage against the bight of the loop and to press the same downward and into the concavity or what might be considered the female-die member 49, in order to form what in the present case is the downward bend at the free end of the loop. Simultaneously with the action of the bending device or die-section 53 the protuberances or die-sections 54 on the under side of the block 55, suitably associated with the upper die member 37, press the blank at opposite sides of the loop into the female-die portions 56 on the lower die member 45, so as to form bends in the wire. The protuberances 54 are of course convex, while the seats 56 are concave. The die-section 55 operates concurrently, as understood, with the die-section or bending device 53.

It will be seen upon reference to Fig. 1 that the cams 38 are so placed as to act in succession on the blank or previously-cut length of

stock, and it will be apparent that they form in the stock crimps at regular intervals, while the wire is free for movement toward its central portion from opposite ends thereof. In other words, there is nothing holding the wire while the crimping mechanisms are acting in sequence.

On the lower or fixed die members 45 are flanges or plates, as 57, (see Fig. 11,) while the standards 36 are provided with substantially similar flanges 57, the wire which is to constitute the blank being fed between the superposed flanges. Said flanges serve to prevent lateral displacement, or upward-and-downward movement in the present case, of the crimps when formed, so that when the finished product or stay-wire is removed from the action of the die mechanisms all the crimps will be in line. The flanges 57 and 58 are shown in Fig. 11, for example, as being toward the right die-forming mechanism therein represented, as when a second crimp is formed the wire at the crimp is drawn away from such mechanism such a distance that the crimp will be positioned between the superposed flanges 57 and 58.

Each standard 36 carries a lug 59, which prevents upward displacement of the body of the wire or blank, which, as will be understood, rests on the upper side of the rear portion of the die member 45 as it is being crimped.

To prevent vibration of the leading end of the wire as the same is advanced through the machine, we provide at suitable intervals guide devices, as 60, of any desirable number and shown clearly in Fig. 16. These guide devices coöperate with the upper flanges 58 hereinbefore described and constitute, in effect, tops therefor, and said flanges, as indicated, also constitute lateral stops for the crimps. The guide devices 60 are in the form of arms pivotally united in some suitable way between their ends with the respective standards 36 and normally maintained in their working positions and in contact with the respective flanges 58 by means of springs 62. (See, for example, Fig. 6.) The head end of each rock-arm 60 is grooved in its upper surface, the groove having a tapered throat for the proper entrance thereinto of the wire, which when it enters the respective grooves is contiguous to the under sides of the several flanges 58. The operating devices for the several rock-arms 60 consist of tappets 63, suitably rigidly fastened to the shaft 64, extending longitudinally of the machine within the bed thereof. It will be understood that when the tappets 63 are swung toward the right in Fig. 6 the lower arms of the rocking guide-arms 60 will be moved in a corresponding direction thereby, so as to lower the upper branches of said guide-arms and carry them wholly free of the

crimped wire, whereby the latter can be positively moved away from the die mechanisms.

On the forward end of the shaft 64 is a rock-arm 65, connected by a loose joint with the rocking lever 66, (see Fig. 3,) adapted to be operated at its upper end by one portion of the duplex cam 67 on the main shaft 5, that portion of the cam 67 which coöperates with the lever 66 being effective to actuate said lever after all the crimps have been formed, whereby the guide members 60 will, through the intermediate parts described, be swung away from the crimped wire.

After the crimped wire is released by the guide members 60 it is forcibly ejected from the die mechanisms, and in the present case it is projected into a chute, as 68, of approximately arcuate form, where it falls onto holding-fingers, as 69, working through slots formed in the opposite walls of said chute. When the fingers are operated as will hereinafter appear to release the crimped product, the latter falls through the delivery end of the chute and onto a receiving board or table 70, said table and chute being assembled with the framing of the machine in any desirable way. The crimped product when it falls on the table is advanced forward thereon positively, whereby the crimped articles can be successively nested at a point beyond the delivery end of the chute, and when the bunch is at a desired height it may be removed.

As hereinbefore stated, each cam 38 has a portion 43 for forcing down the die 37 in order to effect the operation of the loop-forming device and a releasing portion 41. When the cam portion 43 passes off the roll 40, the die 37 will be thrust upward to carry the roll against the portion 41 of the cam and all of the rolls 40 will be up against the coöperating cam portions 41 at the same time, this occurring after all the crimps have been formed, so that all parts of the upper die member 37 are out of the path of movement of the crimped product when the same is forcibly ejected away from the die mechanisms.

The means for ejecting the crimped product from the die mechanisms is shown as consisting of a plurality of upright arms 71, (see, for example, Fig. 6,) suitably rigidly united to the shaft 72, housed within the hollow or chambered bed 2. The arms 71 are held in their ineffective positions by springs 73, connected with the arm 74 and also with suitable fixtures on the framing.

On the shaft 72, near the head end thereof, is a crank-arm 74, connected by a link 75 (see Fig. 3) with the lower end of the lever 76, adapted to be operated by the cam 77. There may be, in fact, two of these cams 77, and two are shown in Fig. 1 as at opposite ends of the shaft 5, their effective portions being so disposed as to strike against the co-

operating levers 76 immediately after the guide members 60 have been moved to a position to release the crimped article. When the cams 77 act, they swing the upper branches of the levers 76 toward the right in Fig. 3, so that the arms 74, through the intermediate connections, are swung in an opposite direction, and hence naturally impart a movement toward the left in Fig. 6 to the ejector-arms 71. As said ejector-arms 71 swing toward the left in said Fig. 6 they engage the crimped article and force it away from the die mechanisms and into the mouth of the chute 68, where the article can gravitate onto the fingers 69.

It will be remembered that the cam 67 has been described as having two portions. One of these portions serves, through the intermediate parts, to control the operation of the guiding members 60, the other part thereof, through intermediate connections, serving to operate the fingers 69 in a direction to release the crimped article upheld thereby. Said fingers are carried on a suitably-supported shaft 77^a, (see Fig. 3, for example,) from which a rock-arm 78 extends rearward, the rear portion of the rock-arm being connected by a link 79 with the lever 80, supported by the framing of the machine and the lower branch of which is connected with a spring 81, connected in turn with the framing, which spring serves to normally hold the fingers through the intermediate parts in their product-holding position. When the effective portion of the cam 67 rocks the lever 80, the fingers 69, through the intermediate parts, will be swung downward, so as to free the crimped article carried thereby, whereby the said article can fall through the chute and onto the inner end of the table 70 and into the path of a slide 82. To the rear end of the slide 82 are connected rods 83, connected loosely to the lower ends of the rock-levers 85, fulcrumed between their ends on suitable brackets carried by the framework of the machine.

The upper branches of the rock-levers 85 are connected by pitmans 86 and eccentrics 87 with the main shaft 5, so that on the rotation of said main shaft and when the crimped product is in front of the slide 82 said slide will be advanced, through the intermediate parts, to push said crimped product toward the front of the table 70 and away from the delivery-outlet of the chute 68.

It should be stated that the standards 36, between the upper forked or slotted ends of which the cams 38 are located, are adjustable longitudinally of the bed of the machine, so as to regulate the distance between the crimps and the distance between the terminal crimps and the ends of the blank. To secure this result, each standard is shown as equipped with a depending stem 88, (see, for example, Fig. 6,) having a transverse foot 89,

held in place by a nut 90 and the opposite ends of which are adapted to engage under flanges, as 91, on the inner faces of the opposite walls of said bed. By tightening up the nuts 90 the bases or feet 89 of the respective standards 88 are adapted to bind solidly against the flanges 91 to hold the standards in their predetermined positions. By loosening said nuts the standards can be readily moved longitudinally of the bed to separate them.

The operation, briefly set forth, is as follows: A wire is fed to the machine in any desirable way and prior to its operation by the die mechanism hereinbefore described is straightened. After being straightened it is advanced through the machine and when it is moved a certain distance throws the main shaft into action, whereby when the main shaft operates the die means are caused to successively act to crimp a wire at different points in its length and in uniform distances apart. The instant that the predetermined length of wire or blank is cut off the feed of the main portion of the wire is stopped, as hereinbefore set forth. After the wire has been cut to form the blank the latter is successively crimped and when crimped is positively moved away from the crimping means.

During the crimping operation it will be apparent that the blank is held against torsional motion, whereby the crimps will be maintained in alinement.

Having thus described the invention, what we claim is—

1. A wire-working machine having mechanism for successively forming crimps in a wire blank and while said wire blank is free throughout its entire length for movement from its opposite ends toward the intermediate portion thereof.

2. A wire-working machine having mechanism for cutting off a predetermined length of wire to constitute a blank, and mechanism for successively forming crimps in said wire blank and while the same is free throughout its entire length for movement from its opposite ends toward the intermediate portion thereof.

3. A wire-working machine having mechanism for successively forming crimps in a wire blank and while said blank is free throughout its entire length for movement from its opposite ends toward the intermediate portion thereof, and mechanism for positively moving the finished product away from the crimp-forming mechanism when the operation of the latter is concluded.

4. A wire-working machine having means for feeding the wire, cutting mechanism for severing the wire into a predetermined length to constitute a blank, crimping mechanism, and mechanism actuated by the wire to throw the cutting and crimping mechanisms into action.

5. A wire-working machine having means for feeding the wire, cutting mechanism for severing the wire into a predetermined length to constitute a blank, crimping mechanism, mechanism for successively operating the cutting and crimping mechanisms, and mechanism actuated by the wire to throw the operating mechanisms for the cutting and crimping mechanisms into action.

6. A wire-working machine having a shaft, a driving member movable independently of said shaft, a clutch member for coupling the driving member to the shaft, a pair of feed-rollers for frictionally engaging the wire to normally feed the same, said feed-rollers being geared to and continuously operable by said driving member, cutting mechanism for cutting the wire into a predetermined length to form a blank, mechanism actuated by the wire for causing the clutch to couple the driving member to said shaft, and crimping mechanism for the wire operated from said shaft after the wire has been cut to form a blank.

7. A wire-working machine having a shaft, a continuously-operable power-driven member, friction wire-feeding mechanism connected with and continuously operable by the said power-driven member, and mechanism operable by the wire for putting the shaft into operative relation with the power-driven member, and cutting and crimping mechanisms to operate successively upon the wire and actuated from said shaft.

8. A wire-working machine having a shaft, a driving member movable independently of said shaft, a clutch member for coupling the driving member to the shaft, means for feeding the wire, cutting mechanism for cutting the wire into a predetermined length to form a blank, mechanism actuated by the wire for causing the clutch to couple the driving member to said shaft, and crimping mechanism for the wire operated from said shaft after the wire has been cut to form a blank.

9. A wire-working machine having crimping mechanism, means for presenting a blank to the crimping mechanism, and means into which the crimp is drawn after its formation, acting against said crimp to prevent lateral motion thereof.

10. A wire-working machine having a shaft, a continuously-operable power-driven member, friction wire-feeding means connected with and continuously operable by said power-driven member, a shaft, means actuated by the wire for throwing the shaft into working relation with the power-driven member to thereby cause the turning of the latter, wire-cutting mechanism actuated from said shaft to cut the wire into a predetermined length, and crimping and ejecting mechanisms to act in succession upon the cut wire and operable also from said shaft.

11. A wire-working machine having mechanism for forming crimps at predetermined

distances in the length of a wire blank and while said wire blank is free for movement from its opposite ends toward the intermediate portion thereof, and superposed flanges between which the blank is located and serving to positively prevent lateral motion of the crimps during the action of the crimp-forming mechanism.

12. A wire-working machine having wire-feeding means, cutting mechanism arranged to cut a wire into a predetermined length to constitute a blank, crimping mechanism for forming a succession of crimps in the blank and while the latter is free for movement from its opposite ends toward the intermediate portion thereof, and mechanism arranged to be actuated by the wire for throwing the cutting and crimping mechanisms successively into action.

13. A wire-working machine having mechanism for feeding the wire, mechanism for cutting the wire into a predetermined length to constitute a blank, crimping mechanism for operating on the blank, a wire-guide to prevent vibration of the leading end of the wire, and mechanism for operating said wire-guide to release the crimped blank.

14. A wire-working machine having mechanism for feeding wire, means for cutting the wire into a predetermined length to constitute a blank, mechanism for forming a succession of crimps in the wire blank, guides through which the leading end of the wire is fed and serving to prevent vibration thereof, and mechanism for actuating the guides to release the crimped blank.

15. A wire-working machine having mechanism for successively forming crimps in a wire blank and while the same is free for movement from its opposite ends toward the intermediate portion thereof, means for positively moving the crimped product away from the crimping means, a chute to receive the crimped product, and means for moving the crimped product away from the delivery end of the chute.

16. A wire-working machine having mechanism for successively forming crimps in a wire blank, means for positively forcing the crimped product away from the crimping means, a chute to receive the crimped product, means in the chute to momentarily arrest the descent of the crimped product through the chute, mechanism for actuating the arresting means to release the crimped product whereby it can fall through the delivery end of the chute, and means for positively moving the crimped product away from the delivery end of the chute.

17. A wire-working machine having wire-feeding means, means for cutting the wire into a predetermined length to form a blank, crimping mechanism arranged to operate on the blank, mechanism for positively forcing the crimped product away from the crimping

means, a chute to receive the crimped product, a table arranged to receive the crimped product from the chute, and means for advancing the crimped product along the table and away from the delivery end of said chute.

18. A wire-working machine having wire-feeding means, cutting mechanism arranged to cut the wire into a predetermined length to form a blank, a plurality of crimping mechanisms arranged to act in succession and after the operation of the cutting mechanism, a shaft having a plurality of cams arranged to operate the cutting and crimping mechanisms, and mechanism arranged for operation by the wire to actuate said shaft.

19. A wire-working machine having means for feeding the wire, a tube arranged to receive the advance end of the wire, a rod in said tube adapted for longitudinal movement by the wire, a shaft, cutting and crimping mechanisms arranged to successively operate upon the wire, cam devices for actuating said cutting and crimping mechanisms, and mechanism arranged for operation by said rod, when it is operated by the wire, to start the shaft in operation.

20. A wire-working machine having a pair of suitably-operated rolls adapted to frictionally advance the wire through the machine, cutting mechanism including a perforated cutting member, through the perforation of which the leading end of the wire extends, the perforated cutting member being arranged to press the wire downward to cut the same and against the other cutting member to arrest the feed of the wire, and means for successively forming crimps in the cut length of wire and while said cut length of wire is free for movement from its opposite ends toward the intermediate portion thereof.

21. A wire-working machine having a die member provided with projecting legs, and a loop-forming device arranged for movement between said legs.

22. A wire-working machine having a fixed die member, a reciprocating die member having projecting legs, the fixed die member being apertured to receive said legs, and a loop-forming device arranged for movement between said legs.

23. A wire-working machine having a fixed die member, a reciprocating die member having projecting legs, the fixed die member being apertured to receive said legs, and a loop-

forming device arranged for movement between said legs, the fixed die member being channeled to receive and guide said loop-forming device.

24. A wire-working machine having a fixed die member, a reciprocating die member having projecting legs, the fixed die member being apertured to receive said legs, and a loop-forming device arranged for movement between said legs, said reciprocating die member and loop-forming device having cooperating means to form a bend at the free end of the loop.

25. A wire-working machine having a fixed die member, a reciprocating die member having projecting legs, the fixed die member being apertured to receive said legs, and a loop-forming device arranged for movement between said legs, said reciprocating die member and loop-forming device having cooperating means to form a bend at the free end of the loop, and said two die members having cooperating means to form bends in the body of the wire at the loop.

26. A wire-working machine having means for feeding the wire, means for cutting the wire into a predetermined length to constitute a blank, mechanism for successively forming crimps in the blank while the same is free for movement from its opposite ends toward the intermediate portion thereof, said crimping mechanism involving fixed and reciprocating dies, means for moving the reciprocating dies away from their normal range of action, and means for ejecting the crimped product after said movement of the reciprocating dies.

27. A wire-working machine having means for presenting the wire, means for cutting the wire into a predetermined length to form a blank, and means for successively forming crimps in said blank and while the blank is free throughout its entire length for movement from its opposite ends toward the intermediate portion thereof.

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 JANSSEN.