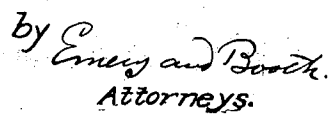


APPLICATION FILED JULY 24, 1908.

5 SHEETS—SHEET 1.

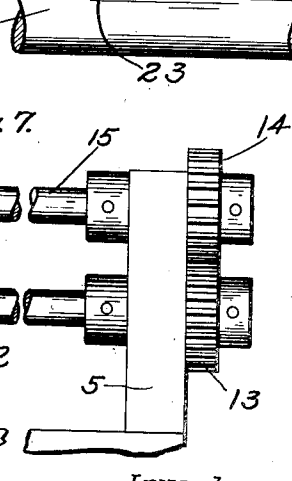
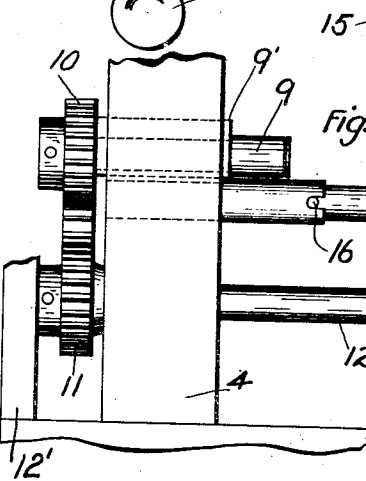
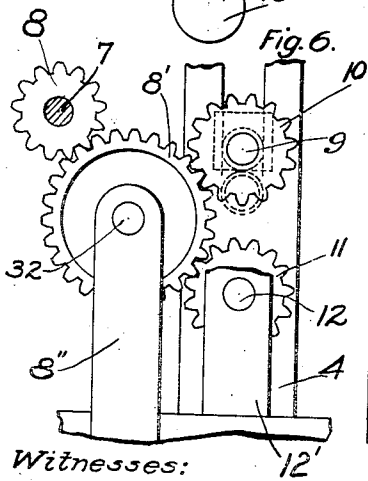
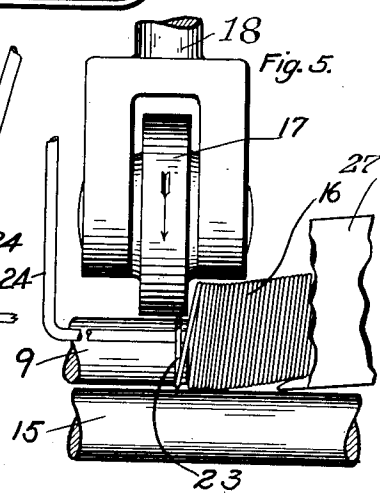
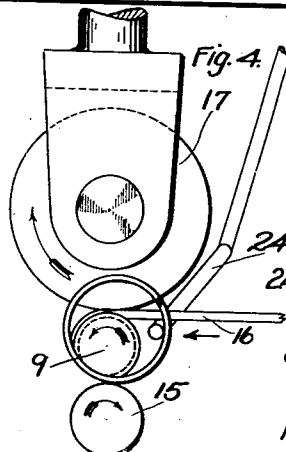
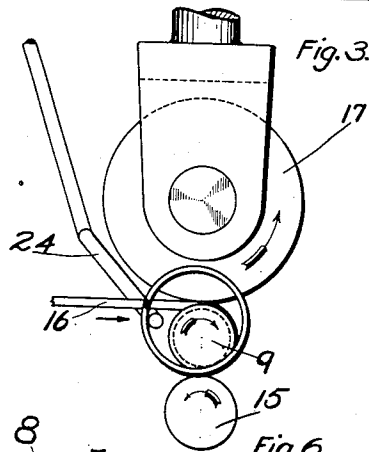
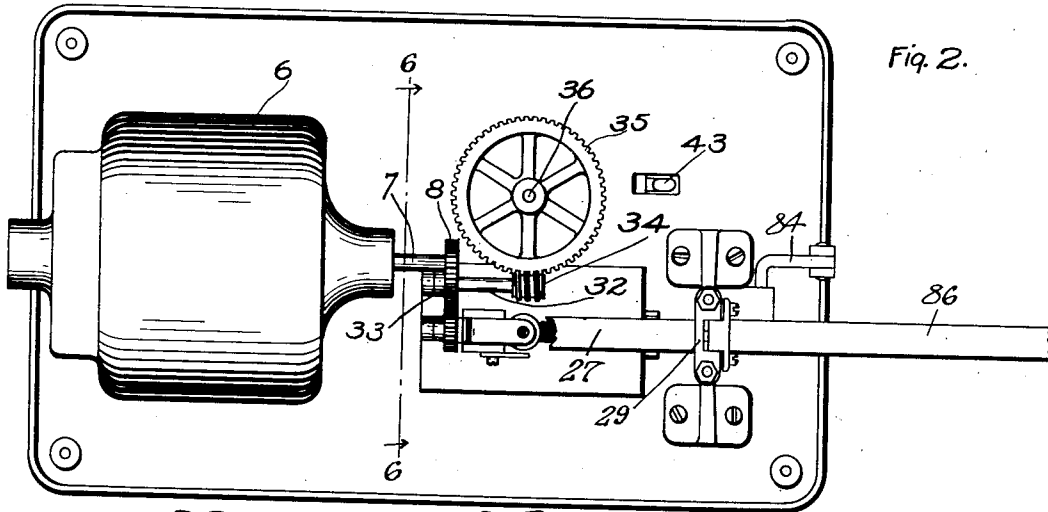


E. F. HATHAWAY AND C. LEA.
WIRE COILING MECHANISM.
APPLICATION FILED JULY 24, 1908.

1,367,814.

Patented Feb. 8, 1921.

5 SHEETS—SHEET 2.



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5 SHEETS—SHEET 3.

Fig. 8

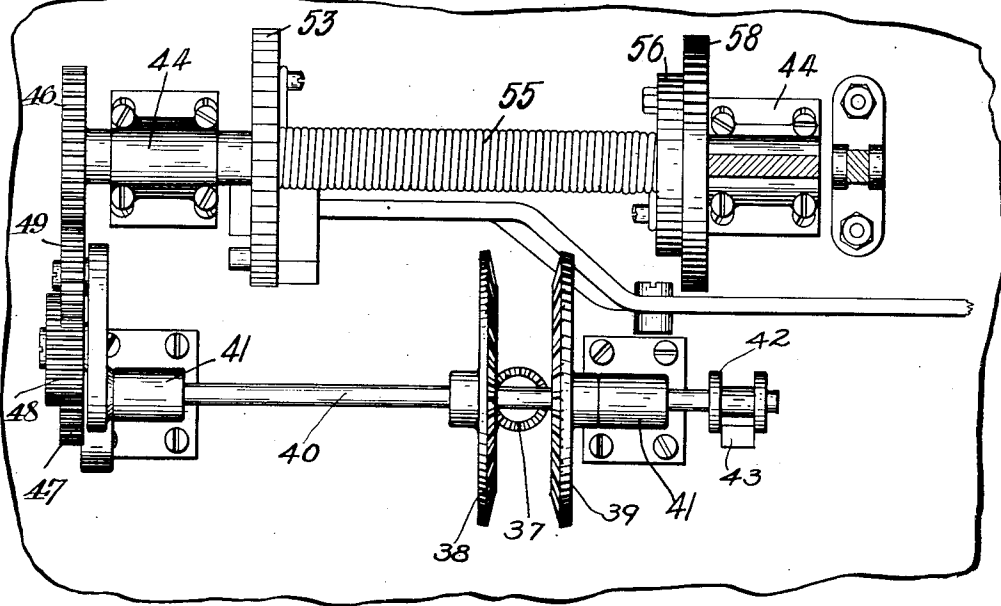


Fig. 9

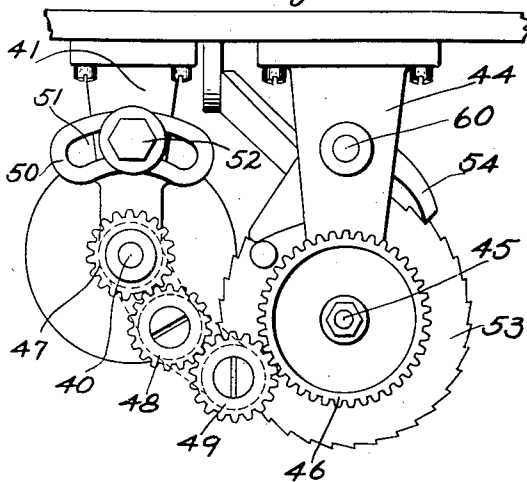
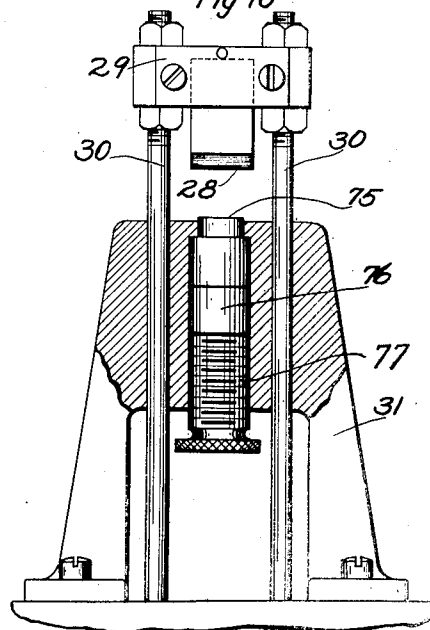


Fig. 10



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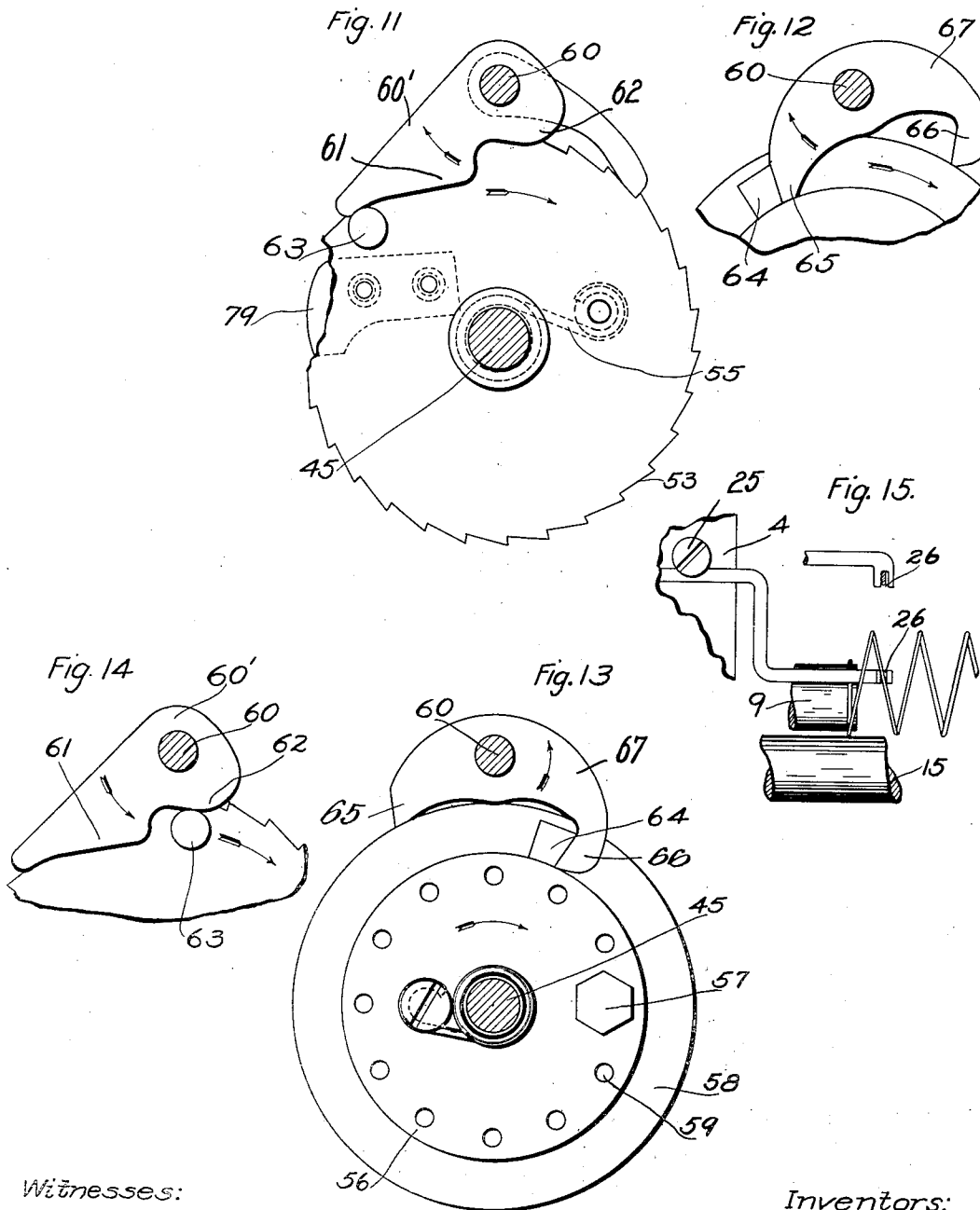
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WIRE COILING MECHANISM.
APPLICATION FILED JULY 24, 1908.

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5 SHEETS—SHEET 4.



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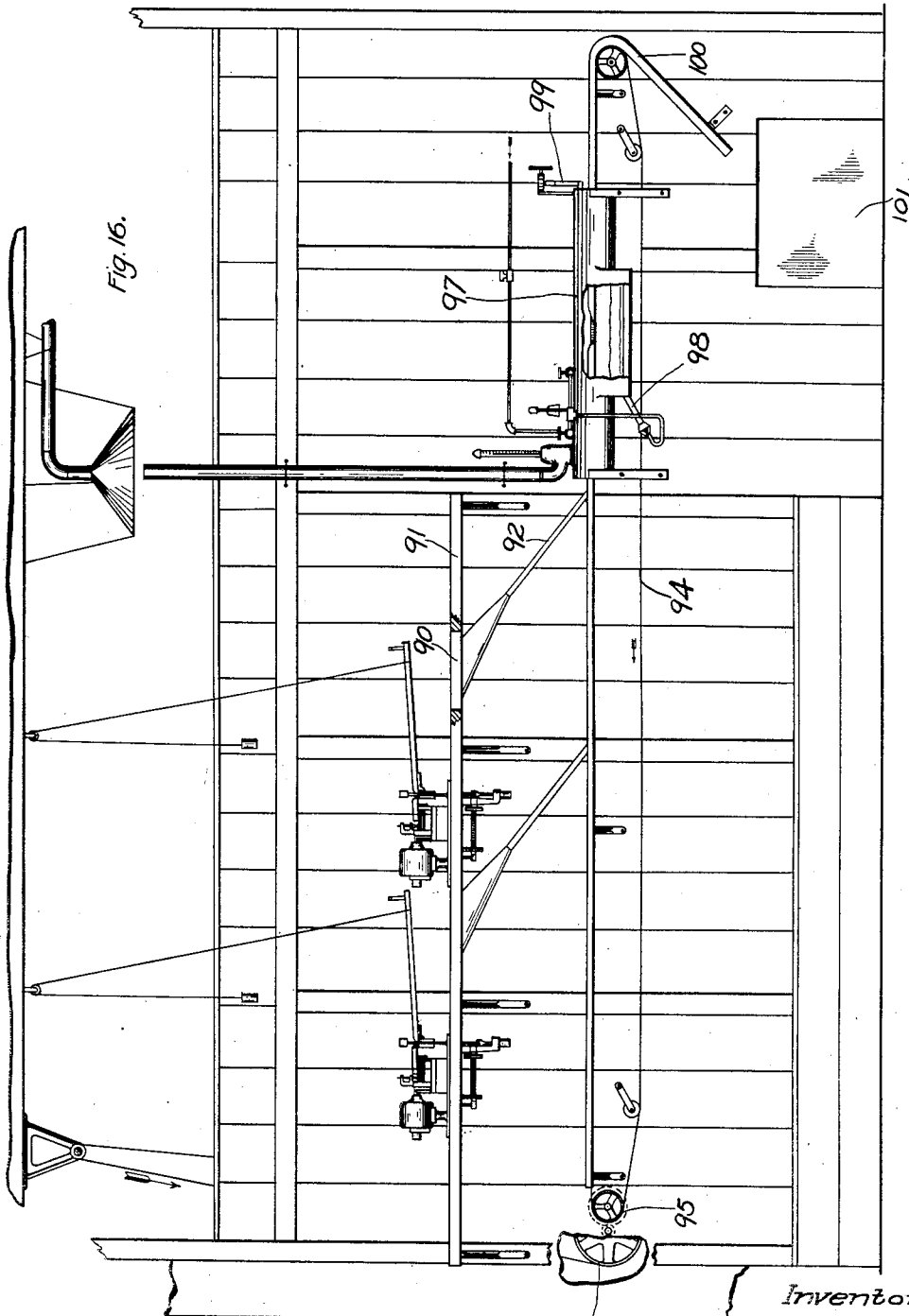
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WIRE COILING MECHANISM.
APPLICATION FILED JULY 24, 1908.

1,367,814.

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5 SHEETS—SHEET 5.



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UNITED STATES PATENT OFFICE.

EDGAR F. HATHAWAY, OF DORCHESTER, AND CHARLES LEA, OF BOSTON, MASSACHUSETTS, ASSIGNORS, BY MESNE ASSIGNMENTS, TO BARBER-COLMAN COMPANY, OF ROCKFORD, ILLINOIS, A CORPORATION OF ILLINOIS.

WIRE-COILING MECHANISM.

1,367,814.

Specification of Letters Patent.

Patented Feb. 8, 1921.

Application filed July 24, 1908. Serial No. 445,160.

To all whom it may concern:

Be it known that we, EDGAR F. HATHAWAY and CHARLES LEA, both citizens of the United States, and residing, respectively, at
5 Dorchester and Boston, both in the county of Suffolk and State of Massachusetts, have invented an improvement in Wire-Coiling Mechanism, of which the following description, in connection with the accompanying
10 drawings, is a specification, like figures on the drawings representing like parts.

The object of the invention is to provide improved mechanism for forming wire coils. In order that the principle thereof may
15 readily be understood we have disclosed a single embodiment of the invention in the accompanying drawings, wherein—

Figure 1 is a front elevation of a wire coiling mechanism embodying our invention;
20

Fig. 1^a is a fragmental top plan view showing the anvil 75 and the chutes 27 and 86.

Fig. 2 is a plan view thereof;

25 Fig. 3 is an end elevation, somewhat diagrammatic, of the wire contacting portions of the wire coiling means, the wire being coiled to the right to form a "left hand" spring;

30 Fig. 4 is a similar view of the same parts, but oppositely driven to coil the wire in the opposite direction;

Fig. 5 is a side elevation of the parts represented in Fig. 3;

35 Fig. 6 is an end elevation, looking from the left in Fig. 2, of the means for driving the mandrel and mandrel cooperating member;

40 Fig. 7 is a side elevation of the parts represented in Fig. 6;

Fig. 8 is an underneath plan view of certain of the operating parts underlying the wire coiling mechanism proper;

45 Fig. 9 is an end elevation of the mechanism for operating the escapement and rock shafts;

Fig. 9^a is a detail representing a portion of the mechanism shown in Fig. 1.

50 Fig. 10 is an end elevation looking from the right in Fig. 1 of a portion of the coil severing mechanism;

Fig. 11 is a left hand end elevation of a

portion of the escapement mechanism and parts cooperating therewith;

Fig. 12 is a detail representing the normal position of portions of the escapement mechanism;
55

Fig. 13 is an end elevation of a portion of the escapement mechanism as positioned just prior to the release thereof;
60

Fig. 14 is a detail representing in side elevation the rock shaft and mechanism for rocking the same;

Fig. 15 is a detail representing means for forming an open coil; and
65

Fig. 16 is a diagram, representing in side elevation wire coiling means and means for automatically tempering the completed coils.

Referring more particularly to the drawing and to the single embodiment of our invention therein typified, the base of the machine is indicated at 1 in Fig. 1, whereon are supported one or more uprights 2 of any suitable construction suitably supporting a transverse plate 3 rising from which
75 are uprights 4 and 5 wherein are supported the mandrel and driving means therefor. Power may be applied to the mechanism in any suitable manner. Herein we have represented (see Figs. 1 and 2) an electric
80 motor 6 of any suitable type upon the driven shaft 7 whereof is mounted a gear 8. While any suitable wire coiling means may be employed, we have therein represented a mandrel and mandrel cooperating member, preferably a shaft, suitably operated in any convenient manner. The mandrel, indicated at
85 9, is mounted in a removable box 9' in the upright 4, and fast upon one end thereof is a pinion 10 meshing with a gear 8', mounted upon a bracket 8'' removably supported upon the plate 3 and meshing with and driven by the gear 8 upon the motor shaft. Also meshing with the gear 8' is a pinion 11 fast upon a countershaft 12, supported in
90 the uprights 4 and 5 and a removable bracket 12' and having fast upon the opposite end thereof a pinion 13 meshing with a pinion 14 fast upon the mandrel cooperating shaft 15, which herein is represented
100 as removably mounted in the uprights 4 and 5 and as constructed in two portions having a pin and slot connection 16 permitting ready removal of the parts.

It has been customary heretofore to coil wire by feeding the same between rolls driven in opposite directions, the wire being thereby directed against a former, the rolls being relied upon to push or project the wire forward against the former. Such constructions, however, have been defective for the reason that complete control of the wire is lost immediately after its passage between the rolls and more particularly in the case of delicate wires the resulting coils have been of uneven diameter, because of the uneven action of the former thereon. Our invention comprehends a pulling action upon the wire and the constant control of the wire during the coiling thereof, thus preventing variations in the diameter of the coil. While this result may be accomplished in any suitable manner, we have in Figs. 3, 4 and 5 represented one type of mechanism for accomplishing the desired result. Therein the mandrel 9 is represented as supplied with wire from any suitable source, not herein indicated. The said mandrel 9 and mandrel cooperating shaft or member 15 are arranged in parallelism and are represented as driven in opposite directions and as slightly spaced apart to receive between them the wire 16. If desired, means may be employed additional to the shaft 15 to engage the coiling wire. For this purpose we have herein represented a presser roll 17 mounted (see Figs. 1, 3, 4 and 5) upon a spindle 18 vertically supported in a bracket 19 and having a suitable adjustable coil spring 20 to vary the pressure of the roll 17 upon the wire. Herein the bracket 19 is represented as pivoted at 21, a removable pin 22 holding the bracket in upright position. When desired, the presser roll 17 may be readily withdrawn from the mandrel and wire by swinging the bracket 19 to the left, viewing Fig. 1, upon the pivot 21.

The wire to be coiled is fed between the mandrel 9 and the presser roll 17, if the latter be employed, the said mandrel being driven in either direction at any desired speed. Preferably the said mandrel is provided with a groove represented most clearly at 23 in Fig. 5, wherein the wire is received. The mandrel cooperating member or shaft 15 engages the outer face of the wire and is driven at such a peripheral speed in excess of the peripheral speed of the bottom of the groove 23 that said shaft imparts a positive pulling or drawing action to the wire. Inasmuch as the wire is, in the preferred embodiment of the invention, laterally confined by the walls of the groove 23 in the mandrel and while thus positioned is subjected to the drawing action of the shaft 15, complete control of the wire is maintained throughout the coiling action and all deforming of the coils is prevented. In Fig. 5, a wire having an elongated dimension in cross section

is represented as acted upon, it being apparent that a wire having any desired cross section may be coiled in the manner described. The groove 23 may be made of any suitable shape dependent upon the cross sectional shape of the wire; it is preferably formed adjacent the end of the mandrel 9, and the wire 16 after passing between the mandrel and the shaft 15 issues therefrom, as represented in Figs. 3, 4 and 5, as a coil of the desired diameter. Inasmuch as the hardness and temper of the wire are apt to vary, preferably we employ some means acting upon the coiling wire slightly to distend the same to a predetermined diameter; that is to say, the coils are distended to a diameter slightly in excess of that normally resulting from the action thereon of the mandrel 9 and shaft 15. While this result may be accomplished in any suitable manner, we have herein provided a hook or finger 24 which, as represented in Fig. 1, is mounted for axial and rotative adjustment in the upright 4, which for the purpose is provided with a groove or grooves to receive the hook, a set screw 25 being employed to retain the latter in its adjusted position. The inner end of the hook is bent as represented in Figs. 3, 4 and 5 and is received within the coiled wire 16, engaging each coil as it issues from between the mandrel 9 and shaft 15 and imparting thereto a distending action, the amount of which depends upon the radial position of the hook with relation to the axis of the mandrel 9. Preferably the wire is formed into a closed coil, but the coil may be rendered open to a variable and predetermined extent in any suitable manner, as by providing the hook with a groove 26 (see Fig. 15) positioned to receive the wire after the same emerges from the mandrel 9 and shaft 15. The degree of inclination of the wire in its passage from the groove 23 in the mandrel 9 to the groove 26 in the hook determines the character of the coil as regards its closed or open formation. It will be understood however, that the resiliency of the wire is such that the inclination of the spires of the completed coil is less than that represented in Fig. 15.

The coiled wire may be discharged from the mechanism in any suitable manner as a continuous length or in coils of predetermined and variable lengths. In the present embodiment of our invention, we have represented one form of means for automatically severing the coils into predetermined lengths. As shown in Fig. 1, a short trough 27 is preferably removably mounted upon the upright 5 to receive the wire as it is discharged from the mandrel 9, and adjacent the discharge end of the trough is provided a severing blade 28 (see Fig. 10) mounted in a cross head 29 adjustably received upon the upper end of axially reciprocating member 30.

reciprocating rods 30 mounted in a bracket 31 rising from the base 1 of the machine.

While any suitable means may be employed to operate the severing mechanism, yet, inasmuch as preferably the wire is coiled and delivered at a high rate of speed, we provide means acting to impart a rapid severing action to the coil and preferably in such manner as not to interrupt the discharge of the coiled wire. While this result may be variously accomplished, we have herein provided the following mechanism which has been found suitable for the purpose. Suitably mounted in the framing of the machine and as represented in Fig. 2 is a short shaft 32 having a pinion 33 thereon meshing with and driven by the gear 8 and provided with a worm 34 engaging and driving the worm wheel 35 mounted upon a vertically disposed shaft 36, having upon its lower end, as shown most clearly in Fig. 8, a beveled pinion 37 adapted to mesh with either beveled gear 38 or 39 fast upon a horizontally disposed shaft 40 mounted for rotation and longitudinal movement in suitable hangers 41—41 depending from the bed 1 of the machine. Fast upon the said shaft 40, as represented in Fig. 8, is a collar 42, with which engages a lever 43 rising through the bed 1 of the machine, as indicated in Fig. 2, to within convenient access of the operator, whereby either beveled gear 38 or 39 may be brought into engagement with the beveled pinion 37 and the shaft 40 be thereby driven in the same direction, whether the motor shaft be driven forwardly or reversed, it being understood that when the motor shaft is reversed, the gears 38, 39 are shifted. Hence the wire may be coiled in either direction without change in direction of rotation of the shaft 40.

In suitable hangers 44 depending from the bed of the machine we mount a shaft 45 whereon is provided escapement mechanism controlling the operation of the coil severing mechanism. Fast upon the shaft 45 is a gear 46, the number of teeth of this gear determining the length of the severed coil. By removing said gear and substituting one having a different number of teeth, a coil of any other predetermined length may be severed. The said gear 46 is driven from the shaft 40 in any suitable manner, but preferably by pinion 47 fast upon the shaft 40 and pinions 48 and 49 suitably mounted in an adjustable bracket 50 provided with a segmental slot 51 and set-screw 52 whereby the said bracket may be connected to one of the hangers 41 in any position of angular adjustment, so that a gear 46 of any suitable size and number of teeth may be mounted upon the shaft 45 and driven from the shaft 40. Likewise fast upon the shaft 45 is a ratchet gear 53 with which engages a pawl 54 on one of the brackets 44 to prevent retro-

grade movement of said shaft during the substitution of an interchangeable gear 46. Mounted upon the escapement shaft 45 is a coil spring 55, one end whereof, as represented in Fig. 11, is secured to the ratchet 53, the opposite end being secured to a disk 56 loose upon a preferably reduced portion of the shaft 45 (see Fig. 1), the said disk being secured by a bolt 57 to the adjacent disk 58 likewise loosely mounted upon the said shaft, a plurality of openings 59 being provided in the disk 56 to permit rotative adjustment of said disks, and hence the desired degree of tension of the spring 55 in addition to the tension imparted thereto through the gear 46. Likewise mounted in the hangers 44 is a rock shaft 60 disposed in parallelism with and above the escapement shaft 45. Fast upon said shaft is positioned, as shown most clearly in Figs. 11 and 14, a cam 60' having cam portions 61 and 62 adapted to be engaged in turn by a pin 63 laterally extending from one face of the ratchet 53. The change gear 46 and ratchet 53 being driven in the direction of the arrow upon said ratchet in Figs. 11 and 14, the pin 63 engages the cam portion 61 and elevating the same turns the rock shaft 60 clockwise viewing Fig. 14. The continued rotation of the said gear and ratchet brings the pin 63 into engagement with the cam portion 62, thereby rocking the shaft 60 in the opposite direction. Laterally extending from the disk 58 is a lug 64 adapted to engage in succession the teeth 65 and 66 upon a pawl 67 fast upon the rock shaft 60. When, in the rotation of the change gear 46, the pin 63 engages the cam portion 61 and rocks the shaft 60, it thereby elevates the tooth 65, and permits the lug 64 to pass the same and to be engaged by the tooth 66, which has been depressed by the elevation of the tooth 65. Upon the elevation of the cam portion 62 by the pin 63 and the consequent rocking of the shaft 60 in the opposite direction, the tooth 66 of the pawl 67 is elevated, thereby releasing the lug 64 and permitting a nearly complete rotation of the disks 56 and 58 under tension of the spring 55, which is thus intermittently released, further rotation of said disks being prevented by the reengagement of the lug 64 with the tooth 65, as represented in Fig. 12. The tension of the spring 55 is restored by the continued rotation of the gear 46, which is, in this embodiment of the invention, always rotated in the same direction, whether the wire be coiled to the right or to the left. Preferably integrally formed with the disk 58 or with a hub projecting therefrom is a crank disk 68, represented most clearly in Fig. 1, and having thereon a crank pin 69 connected by a link 70 to a cross head 71 connecting the lower ends of the vertically reciprocating rods 30.

It will thus be apparent that by the action of the escapement mechanism, the rods 30 and cross head 29 have imparted thereto a rapid downward and then a return movement, thereby bringing the blade 28 into severing relation with the coil and returning it to elevated position out of the path of movement of the unsevered portion of the coil, and preferably without interrupting the travel thereof. If desired, and as herein represented, a dash pot 72 is mounted upon one of the hangers 44, the piston 73 thereof being connected by a link 74 with the crank pin 69 to cushion the upward stroke of the severing blade 28. Preferably, an anvil 75 of any suitable material and shown most clearly in Fig. 10 is provided to receive the severing blow of the blade 28, the said anvil being mounted in the bracket 31. If desired, the anvil may be cushioned, as by providing a piece of hard rubber 76, which may be compressed to any desired extent, as by an adjusting screw 77 mounted in the bracket 31 and engaging the lower face of said rubber cushion.

If desired and preferably we provide means to spread apart the spires of the coil at the point where the latter is to be severed so as to present unobstructedly that portion of a spire that is in engagement with the anvil 75 to the action of the severing blade 28. This result may be accomplished in any suitable manner, but preferably we provide means acting in conjunction with the discharging means for the severed coil. While such mechanism may be operated in any suitable manner, we have herein provided upon the ratchet 53, as shown most clearly in Fig. 11, a cam 79 upon the face of the ratchet 53 opposite the pin 63, to engage the end 80 of a lever pivoted at 81 in a hanger depending from the bed of the machine, as represented most clearly in Fig. 1, the opposite end 82 of the lever being pivotally connected by means of a link 83 having a right and left screw threaded connection to the projecting portion 84 of a rock shaft 85 loosely mounted in the framing of the machine and having secured thereon, but preferably in a removable manner, a discharging trough 86. As shown in Fig. 1^a, the bottom of the trough 86 is cut away from a point adjacent to the axis 85 to the anvil 75, the intervening space being closed by a stationary plate 27^a which is virtually a continuation of the chute 27. Engagement of the lug 79 with the lever arm 80 depresses the link 83 and thereby the discharging trough 86. As the trough 86 swings down, the weight of the coil lying in said trough causes the coil to stretch for some little distance in the region of the shear, thus spreading apart the spires of the coil. The timing of the parts is therefore such that the commencement of the downward movement of

the discharging trough 86 slightly precedes the severing stroke of the blade. Such downward movement of the discharging trough continues after the severing action, and in the present embodiment of our invention, the outer end of the said trough is received in a suitable opening in the table whereon the mechanism is mounted.

If desired we may provide the trough 86 with a valve permitting at the proper time the discharge of the severed coil. Herein for the purpose, we have represented most clearly in Fig. 1 a valve 87 mounted in a sleeve 88 laterally extending from the trough 86. The stem of said valve is provided with a cross arm 89 adapted in the downward movement of the trough 86 to straddle an opening 90 in the table 91 (see Figs. 1 and 16), whereon the machine may be supported, the end of the trough depending into the said opening and, when the valve is opened, discharging the coil into any suitable receptacle, and herein into the chute 92. The elevation of the trough 86 is assisted by a weight 93.

If desired, we may provide means for tempering the completed coils. Herein for the purpose we have provided means for automatically tempering the coils discharged from a plurality of wire coiling mechanisms. Referring more particularly to Fig. 16, the chutes 92 discharge the coils onto a preferably steel endless belt 94, suitably supported and driven continuously at the proper rate of speed in any suitable manner, as by a gear 95 driven by a pulley 96. The belt 94 passes through a suitable tempering furnace 97 that may be heated as by Bunsen burners 98 to any proper temperature, which is maintained constant by a thermostat 99. The chutes 27, 86 and 92 and the conveyer 94 constitute means for guiding the coils for longitudinal movement and serve to restrain the coils against entanglement. The tempered coils upon emerging from the furnace are discharged by a chute 100 into any suitable receptacle 101.

The wire to be coiled is fed between the mandrel and the presser roll, the mandrel co-operating member or shaft 15 engaging the outer face of the wire and being driven at such peripheral speed in excess of the speed of the mandrel 9, that a positive pulling or drawing action is imparted to the wire, complete control of the wire being maintained throughout the coiling action, so that all deforming of the coils is prevented. The coils are distended to a predetermined diameter, which is preferably slightly in excess of that normally resulting from the action thereon of the mandrel 9 and shaft 15. The coiled wire is automatically severed into predetermined lengths by suitable mechanism and preferably without stopping the movement of the wire. The severed coils are

conveyed automatically through a suitable tempering mechanism.

Having thus described one type or embodiment of the invention, we desire it to be understood that although specific terms are employed, they are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims.

10 Claims.

1. Mechanism for acting upon wire, comprising a wire coiling mechanism comprising a mandrel, means to rotate the same, whereby a wire presented thereto may be coiled thereabout, a rotatable wire drawing device engaging the wire coiled on the mandrel, means to rotate said device at a speed in excess of that of the mandrel, thereby to draw the wire while coiled on the mandrel, and means for severing the coiled wire.

2. A wire coiling mechanism, comprising a mandrel mounted and arranged to receive thereabout a coiling wire, means to rotate the same whereby a wire presented thereto may be coiled thereabout, a rotatable wire drawing device engaging the outer surface of the wire coiled on said mandrel, means to rotate said device at a surface speed in excess of that of the mandrel, thereby to draw the wire while coiled on the mandrel, and means for severing the coiled wire.

3. A wire coiling mechanism, comprising a mandrel mounted and arranged to receive thereabout a coiling wire, means to rotate the same whereby a wire presented thereto may be coiled thereabout, a rotatable wire drawing device engaging the outer surface of the wire coiled on the mandrel, means to rotate said device at a surface speed in excess of that of the mandrel, thereby to draw the wire while coiled on the mandrel, and automatically actuated means for severing the coiled wire.

4. A wire coiling mechanism, comprising a mandrel mounted and arranged to receive thereabout a coiling wire, means to rotate the same, whereby the wire presented thereto may be coiled thereabout, said mandrel having a wire receiving groove, a rotatable wire drawing device engaging the outer surface of the wire in said groove upon the mandrel, means to rotate said device at a surface speed in excess of the speed of the base of said groove, thereby to draw the wire while coiled on the mandrel in said groove, and means for severing the coiled wire.

5. Mechanism for acting upon wire comprising a wire coiling instrumentality, a wire severing instrumentality, means for periodically operating said severing instrumentality, and a controller operatively connected to said severing means to vary the periodicity of action thereof.

6. Wire coiling means including a man-

drel whereon the wire is coiled and a mandrel cooperating member and a coil distending instrumentality independent of said means and positioned to distend the spires of the coil as it is coiled by said means.

7. Mechanism for acting upon delicate fine wire comprising means to coil the wire, means to sever the coiled wire while the wire is still engaged by the coiling means, means to heat the severed lengths of coiled wire, and means for guiding said lengths to move longitudinally from the severing means to the heating means.

8. Wire coil forming mechanism comprising a mandrel and mandrel cooperating member to coil the same, and means extraneous to and cooperating with said mandrel and member to distend the diameter of the completed coil.

9. Wire coil forming mechanism comprising a mandrel and mandrel cooperating member to coil the wire, means to drive said member at a higher surface speed than the wire supporting portion of the mandrel, and means extraneous to and cooperating with said mandrel and member to distend the diameter of the completed coil.

10. Wire coiling mechanism comprising a mandrel, means to rotate the same thereby to coil thereon a wire presented thereto, a wire drawing instrumentality engaging the wire coiled upon the mandrel, and means to impart a surface movement to said drawing instrumentality in excess of the surface speed of rotation of the wire supporting portion of the mandrel, thereby to effect a drawing action upon said wire.

11. Wire coiling mechanism comprising a mandrel, rotating means therefor, a wire drawing instrumentality engaging the wire upon the mandrel, and means to move the same while in contact with said wire at a superficial speed exceeding that of the rotation of the wire supporting portion of the mandrel, thereby to effect a drawing action upon said wire.

12. Wire coil forming mechanism comprising a mandrel, a mandrel cooperating member to coil the wire, means to rotate said member at a higher surface speed than the wire supporting portion of the mandrel, and means extraneous to and cooperating with said mandrel and member to distend the diameter of the completed coil.

13. Wire coiling mechanism comprising a mandrel, means to rotate the same thereby to coil the wire thereon, a shaft adjacent said mandrel and between which and said mandrel the wire to be coiled may be presented in contact with both, and means to rotate said shaft at a greater peripheral speed than the wire supporting portion of said mandrel, thereby to effect a drawing of said wire.

14. Wire coil forming mechanism com-

prising a mandrel, a mandrel cooperating member to coil the wire, means to rotate said member at a higher surface speed than the wire supporting portion of the mandrel, and means extraneous to and cooperating with said mandrel and member and positioned to enter the completed coil and distend the diameter thereof.

15 15. Mechanism for acting upon wire comprising means to coil wire and means extraneous to said wire coiling means and adapted to engage the completed spires of the coil and to distend the same to a predetermined diameter.

15 16. Mechanism for acting upon wire comprising means to coil the wire, means extraneous to said wire coiling means and adapted to engage the completed spires of the coil and to distend the same to a predetermined diameter, and means to vary the amount of such distention.

15 17. Mechanism for acting upon wire comprising means to coil the wire and means extraneous to said wire coiling means and positioned and arranged internally to engage the completed spires of the coil and to distend the same to a predetermined diameter.

15 18. Mechanism for acting upon wire comprising means to coil the wire, and coil distending means extraneous to and independent of said wire coiling means and positioned interiorly to engage the coils thereof, thereby to distend the same.

15 19. Wire coiling mechanism comprising a mandrel, means to rotate the same, whereby a wire presented thereto may be coiled thereabout, means whereby the coil may be formed as a closed or open one, and wire drawing means engaging the wire and drawing the same while coiled about the mandrel.

15 20. Mechanism for acting upon wire comprising means to coil the wire, means extraneous to said wire coiling means and adapted to engage the completed spires of the coil, thereby to distend the same to a predetermined diameter, and means for controlling and fixing the degree of openness of the formed coil.

15 21. Wire coil forming mechanism comprising means to coil the wire, and means distinct therefrom and positioned within the coil to control and fix the diameter thereof and the degree of separation of the spires of the coil.

15 22. Wire coil forming mechanism having a mandrel, means to rotate the same, and a hook or finger 24 extending within the coil and engaging the same.

15 23. Wire coil forming mechanism, coil severing mechanism, and means axially to distend, for the action of the severing mechanism, the spires of the coil adjacent the spire that is in the path of the severing mechanism.

24. Wire coil forming mechanism, coil severing mechanism, and means axially to distend the completed coil preliminary to the severing operation.

25. Wire coil forming mechanism, wire severing means and escapement mechanism for operating said severing means.

26. Wire coil forming mechanism, coil severing mechanism operating transversely to the axis of the coil, and means axially to distend the spires of the coil adjacent to a spire in the path of the severing mechanism.

27. Wire coil forming mechanism, coil severing mechanism, and means axially to distend the completed coil in the path of said severing mechanism preliminary to the severing operation.

28. Wire coil forming mechanism comprising means to coil the wire in either direction, coil severing means, and escapement mechanism to operate the severing means.

29. Wire coil forming mechanism comprising a shaft adapted to be driven in either direction, a wire coiling mandrel adapted to be driven thereby in either direction, coil severing means, escapement mechanism having movement of rotation to operate the severing means, and connections intermediate said shaft and the escapement mechanism permitting the reversal of direction of said shaft without change in direction of rotation of the escapement mechanism.

30. Wire coil forming mechanism comprising a shaft adapted to be driven in either direction, a wire-coiling mandrel adapted to be driven in either direction therefrom, a shaft driven by said first shaft, connections between said shafts permitting the continued rotation of the second shaft in the same direction upon reversal of said first shaft, escapement mechanism including a shaft driven from said second shaft, and coil severing mechanism operated by said escapement mechanism.

31. Escapement mechanism for wire coiling mechanism comprising an escapement shaft, a spring connected thereto and tensioned thereby, a rock shaft, a rotary member connected to said spring and held from rotation by said rock shaft, means to rock said shaft, thereby intermittently to release said rotary member, a driving shaft adapted to be driven in either direction and driving connections between the same and said escapement shaft.

32. Wire coil forming mechanism and spring-operated coil severing means cooperating therewith.

33. Wire coil forming mechanism, a reciprocary severing blade, and spring actuated means to impart a severing movement to the blade and to return the same to normal position.

34. Escapement mechanism for wire coil-

- ing mechanism comprising escapement shaft 45, spring 55 connected thereto, disk 56, rock shaft 60 permitting intermittent rotation thereof, a driving shaft adapted to be rotated in either direction, shaft 40 in driving relation with the escapement shaft, and connections permitting the reversal of the driving shaft without reversal of shaft 40.
35. Wire coil forming mechanism comprising a mandrel, means to rotate the same in either direction, a rotary wire drawing member engaging the forming coil, and means to rotate said member in either direction.
36. Wire coil forming mechanism comprising mandrel 9, means to rotate the same in either direction, shaft 15 adjacent said mandrel and adapted to contact with the coil forming thereon, and means to rotate the same in either direction and at a greater surface speed than the mandrel.
37. Wire coil forming mechanism comprising a mandrel 9, gear 10 thereon, shaft 15 adjacent said mandrel, counter shaft 12, gear 11 thereon, means to rotate said gear 11, and transmitting gearing upon countershaft 12 and shaft 15.
38. Wire coil forming mechanism comprising uprights 4 and 5, mandrel 9 mounted in upright 4 and having gear 10, shaft 15 and countershaft 12 mounted in uprights 4 and 5, gear 11 upon countershaft 12, and transmitting gearing 13 and 14 upon countershaft 12 and shaft 15.
39. Wire coil forming mechanism comprising a mandrel grooved to receive the wire coiled thereabout, mandrel rotating means, a shaft adjacent said mandrel and adapted to contact with the wire in said groove and means to rotate said shaft at a surface speed exceeding that of the base of said groove.
40. Wire coil forming mechanism comprising a rotary mandrel whereon the wire may be coiled, means cooperating with the mandrel to complete the coil, and means independent of and extraneous to said mandrel and cooperating means to expand the completed coil to a diameter exceeding that resulting from the operation of the mandrel.
41. Wire coil forming mechanism comprising a rotary mandrel whereon the wire may be coiled, means cooperating with the mandrel to complete the coil, and means independent of and extraneous to said mandrel and cooperating means disposed within the coil and adjustable at varying radial distances from the center of rotation of the mandrel to expand the diameter of said coil.
42. Wire coil forming mechanism comprising means to coil the wire, a member to deliver the completed coil in a direction axially of the coil, and means to impart coil discharging movement thereto.
43. Wire coil forming mechanism comprising means to coil the wire, coil severing means, and oscillatory delivering means for the severed coil.
44. Wire coil forming mechanism comprising means to coil the wire, wire severing means, means to guide the coil to the severing means, discharging means for the severed coil to discharge the coil in the direction of the axis of the coil, and means to impart discharging movement to said discharging means.
45. Wire coil forming mechanism comprising means to coil the wire, severing means, and a change gear operatively connected with the severing means to determine the length of the severed coil.
46. Wire coil forming mechanism comprising means to coil the wire, coil severing means, and a change gear determining the periodicity of action of the severing means.
47. Wire coil forming mechanism comprising means to coil the wire, coil severing means, spring actuated escapement mechanism, and means to vary the primary tension of the spring thereof.
48. Wire coil forming mechanism comprising means to coil the wire, coil severing means, and coil discharging means having provisions to present a momentarily distended portion of the coil to the action of the severing means.
49. Wire coil forming mechanism comprising means to coil the wire, coil severing means, and means to present a momentarily distended spire to the action of the severing means.
50. Wire coil forming mechanism comprising means to coil the wire, a severing blade having a path of movement toward and from the coil, and a resiliently supported anvil positioned in the path of movement of said blade.
51. Wire coil forming mechanism comprising means to coil the wire, a coil severing blade, means to reciprocate the same, an anvil for said blade, a resilient support for the anvil, and an adjustable backing for said support.
52. Wire coil forming mechanism comprising wire coiling means and independent, continuously acting, coil distending means to distend to a uniform diameter the coil formed by said wire coiling means.
53. Wire coil forming mechanism comprising wire coiling means and independent coil distending means to distend to a uniform maximum diameter the diameter of the wire coiled by said wire coiling means.
54. Wire coil forming mechanism comprising in combination distinct but simultaneously acting wire coiling means and wire drawing means, and means engaging the formed coils interiorly thereof to distend them to a predetermined, uniform, maximum diameter.

55. Wire coil forming mechanism comprising means to coil the wire to a substantially uniform diameter throughout, severing mechanism, means to discharge the severed coils individually in the direction of their axes for subsequent treatment, and means to impart coil discharging movement to said means. -
56. Mechanism for acting upon delicate fine wire comprising means to coil the wire, means to sever the wire into predetermined lengths, means to heat the severed lengths of coiled wire, and means for guiding said lengths to move longitudinally from the severing means to the heating means, said guiding means acting to restrain said lengths against entanglement during their travel from the severing means to the heating means.
57. Wire coil forming mechanism comprising in combination wire coiling means, wire severing means, severed coil discharging means, tempering means, and co-acting traveling means receiving the coil from the discharging means and constructed and arranged to convey it through the tempering means.
58. Wire coil forming mechanism comprising in combination means to feed an uncoiled wire and successively acting coiling means, severing means, discharging means, tempering means, and a conveyer between said discharging means and the tempering means.
59. Wire coil forming mechanism comprising coiling means, coil distending means distinct from said coiling means, coil spreading means, and severing means active upon the coil when spread.
60. Wire coil forming mechanism comprising coiling means, coil distending means distinct from the coiling means, means to spread the completed coil, means to sever the coil while spread, means to discharge the severed coil, and means to impart discharging movement to said discharging means.
61. Mechanism for acting upon wire comprising wire coiling means, periodically acting wire severing means, and controlling means for varying the periodicity of action of the severing means.
62. Mechanism for acting upon wire comprising coiling means, a guide arranged to receive the coil emerging from the coiling means and guide said coil for longitudinal movement, a second guide arranged to receive the coil from the first guide and guide the coil for longitudinal movement, coil-severing means arranged to operate between said guides, the second guide being arranged to swing into an inclined position to discharge the severed length of wire, and coil-tempering means arranged to receive the length of wire discharged by the second guide.
63. Wire coiling mechanism comprising a mandrel, means to rotate the same whereby a wire presented thereto may be coiled thereabout, wire drawing means positioned adjacent to the mandrel, so as to engage the outer surface of the wire coiled thereon, and means to move said wire drawing means at a higher surface speed than the wire bearing surface of the mandrel thereby to draw the wire.
64. Wire coil forming mechanism comprising means to coil the wire and coiled wire distending means distinct from and extraneous to said coiling means and internally engaging the completed coil, thereby to distend the diameter of the completed coil.
65. Wire coiling mechanism comprising a mandrel, means to rotate the same, whereby a wire presented thereto may be coiled thereabout, means to control the open or closed character of the coil, and wire drawing means located adjacent to the mandrel and positioned to engage the wire and draw the same while coiled about the mandrel.
66. Wire coil forming mechanism comprising means to coil the wire, coiled wire distending means distinct from but positioned adjacent to the wire coiling means to distend the diameter of the coil, and controlling means to fix the degree of openness of the formed coil.
67. Wire coil forming mechanism comprising means to coil the wire, and diameter fixing means distinct therefrom and positioned within the completed coil and adapted to press thereon to fix the character thereof and the degree of separation of the spires of the coil.
68. Wire coil forming mechanism, coil severing mechanism and coiled wire distending means positioned to engage and axially to distend the spires of the coil adjacent a spire in the path of action of the severing mechanism.
69. Wire coiling forming mechanism, coil severing mechanism, and coiled wire distending means positioned adjacent the latter and operating axially to distend the coil in the path of said severing mechanism preliminary to the severing operation.
70. Wire coil forming mechanism, coil severing means, reciprocating means to operate the same to sever the completed coil, means to operate said reciprocating means without interrupting the delivery of the coil from the forming mechanism, and means to deliver the severed coil.
71. Wire coil forming mechanism comprising means to coil the wire, a reciprocating blade to sever the completed coil, and blade operating means of variable periodicity.
72. Mechanism for acting upon wire comprising a wire receiving mandrel, means to

rotate the same whereby a wire presented thereto is coiled thereabout, a wire drawing instrumentality positioned adjacent the mandrel and in relation thereto to engage the outer surface of the wire as it is being coiled about the mandrel, and means to impart a surface speed to said instrumentality in excess of the surface speed of rotation of the mandrel thereby to effect a drawing action upon the wire.

73. Mechanism for acting upon wire comprising a wire receiving mandrel, means to rotate the same whereby a wire presented thereto is coiled thereabout, a wire drawing instrumentality positioned adjacent the mandrel and in relation thereto to engage the outer surface of the wire as it is being coiled about the mandrel, means to impart a surface speed to said instrumentality in excess of the surface speed of rotation of the mandrel, and serving means for the coiled wire thereby to effect a drawing action upon the wire.

74. Mechanism for acting upon wire comprising a wire receiving mandrel, means to rotate the same whereby a wire presented thereto is coiled thereabout, a co-acting instrumentality to distend the coil when upon said mandrel, a rotatable wire drawing instrumentality positioned adjacent the mandrel and in relation thereto to engage the wire coiled upon the mandrel, and means to rotate said wire drawing instrumentality at a greater surface speed than that of the mandrel.

75. Mechanism for acting upon wire comprising a wire receiving mandrel, means to rotate the same whereby a wire presented thereto is coiled thereabout, a co-acting instrumentality to distend the coil when upon said mandrel, a rotatable wire drawing instrumentality positioned adjacent the mandrel and in relation thereto to engage the wire coiled upon the mandrel, means to rotate said wire drawing instrumentality at a greater surface speed than that of the mandrel, and severing means for the coiled wire.

76. Wire coil forming mechanism, coil severing mechanism operating transversely to the axis of the coil, and means to distend the coil longitudinally and eccentrically adjacent said severing mechanism preliminary to the severing operation.

77. Wire coil forming mechanism, coil

severing mechanism reciprocating transversely to the axis of the coil, and means to distend the coil longitudinally and eccentrically adjacent said severing mechanism preliminary to the severing operation.

78. Wire coil forming mechanism, intermittently acting coil severing mechanism, driving means for said severing mechanism, said means operating to store up power while said severing mechanism is inoperative and to deliver it in the action thereof.

79. Wire coil forming mechanism, intermittently acting coil severing mechanism, continuously actuated driving means for said severing mechanism, said means operating to store up power while said severing mechanism is inoperative and to deliver it in the action thereof.

80. Wire coil forming mechanism, intermittently acting coil severing mechanism, driving means for said severing mechanism; said means operating to tension a spring while said severing mechanism is inactive and to move said spring to act on said mechanism.

81. Mechanism for acting upon wire comprising means to coil a delicate fine wire while cold, means to temper said wire after coiling, and automatically acting means to deliver the coiled wire from the coiling means to and through and to discharge it from said tempering means.

82. Mechanism for acting upon wire comprising means to coil a delicate fine wire, means to sever the coiled wire, means to temper the said severed wire, and continuously acting means to pass the said severed coils to and through said tempering means.

83. Mechanism for acting upon wire comprising means to coil a delicate fine wire while cold into a closed coil having contacting spires, means to temper said wire after coiling, and automatically acting means to deliver the coiled wire from the coiling means to and through the said tempering means.

In testimony whereof, we have signed our names to this specification in the presence of two subscribing witnesses.

EDGAR F. HATHAWAY.
CHARLES LEA.

Witnesses:

IRVING U. TOWNSEND,
EVERETT S. EMERY.