No. 882,385. PATENTED MAR. 17, 1908.

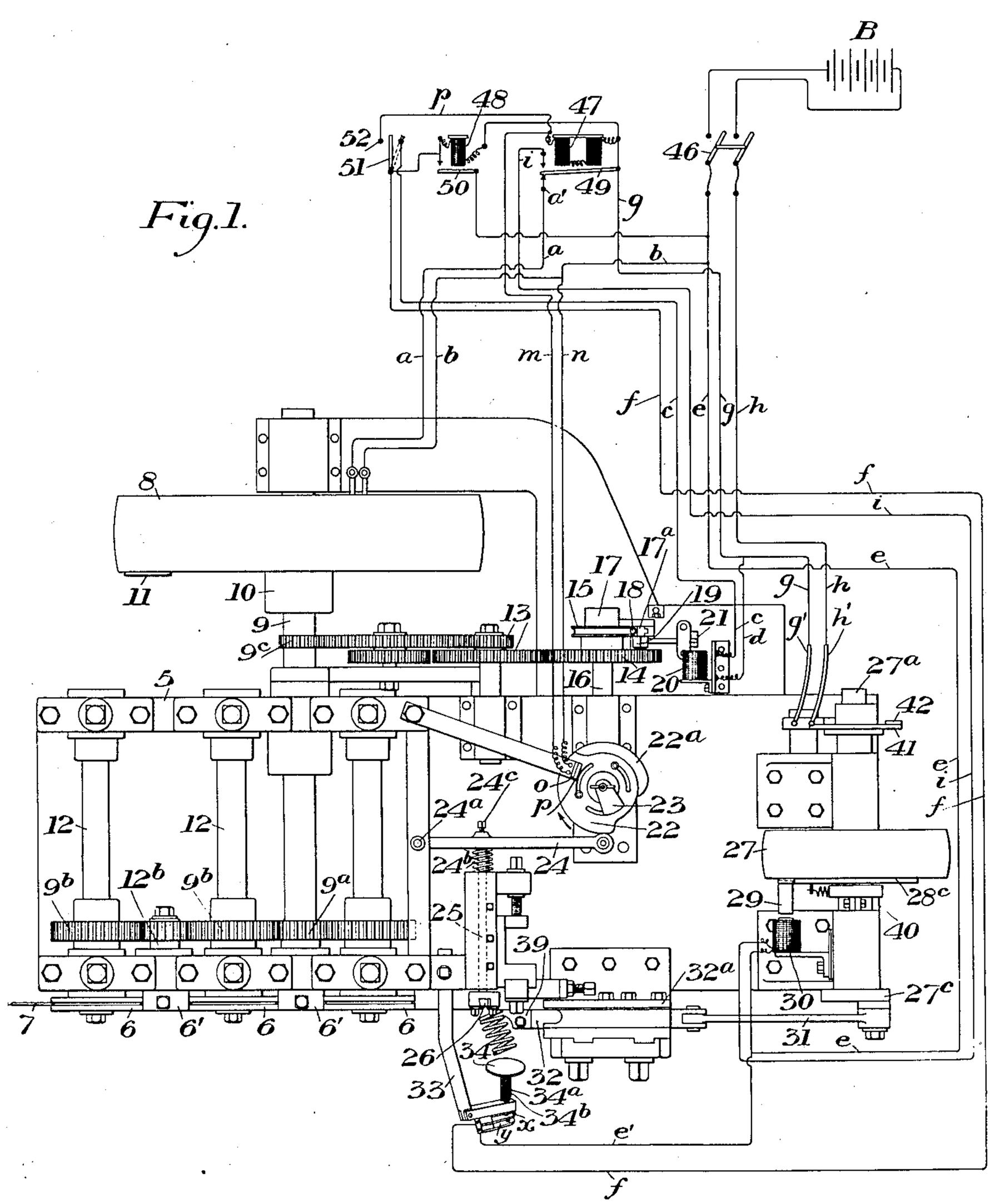
N. S. HARTER.

# MACHINE FOR THE MANUFACTURE OF COILED SPRINGS.

APPLICATION FILED DEC. 2, 1907.

4 SHEETS—SHEET 1.

Fig. 1.




WITNESSES

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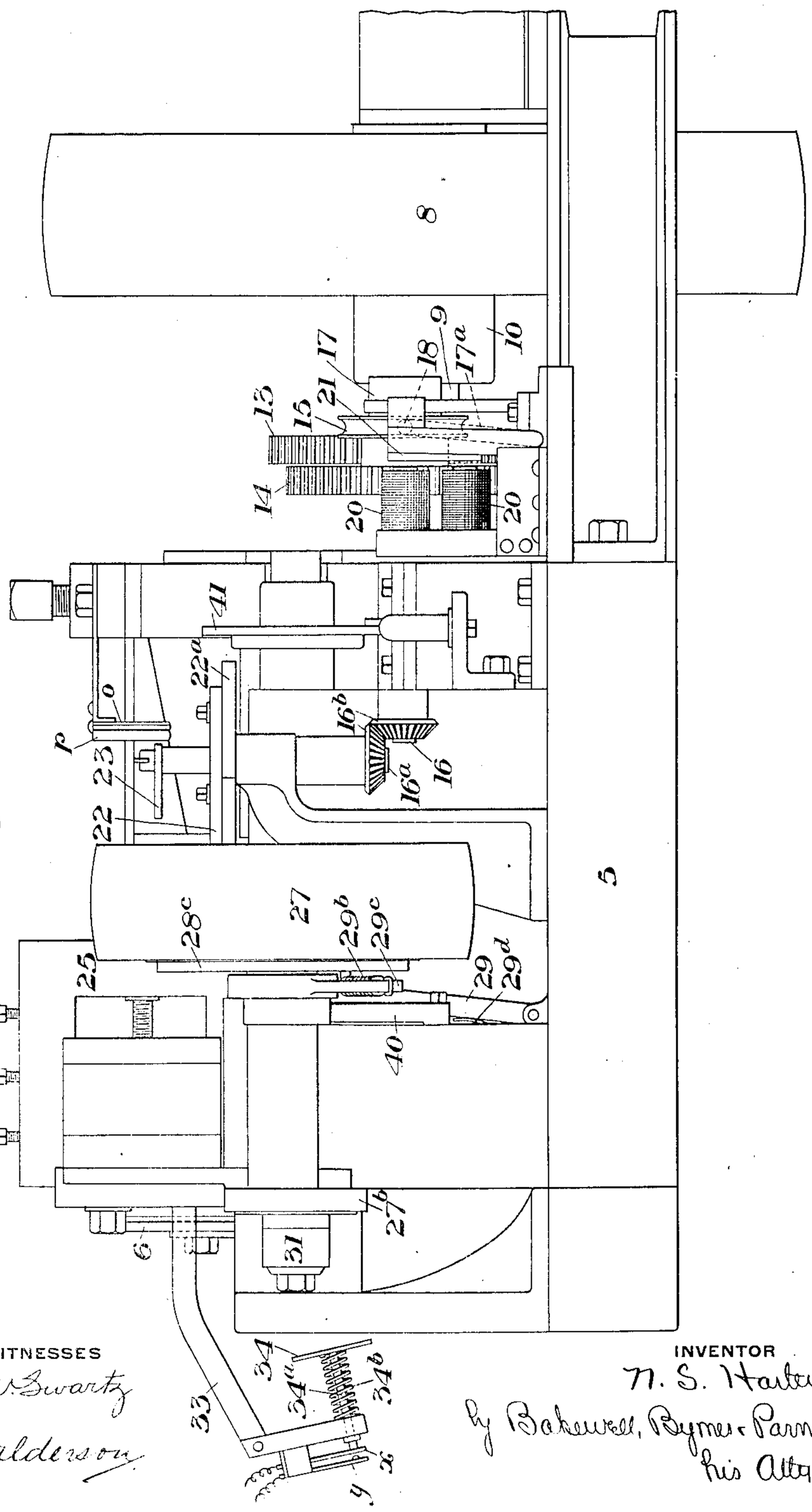
4 SHEETS—SHEET 2.

Fig. 2.

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4 SHEETS—SHEET 3.

*Fig. 3.*

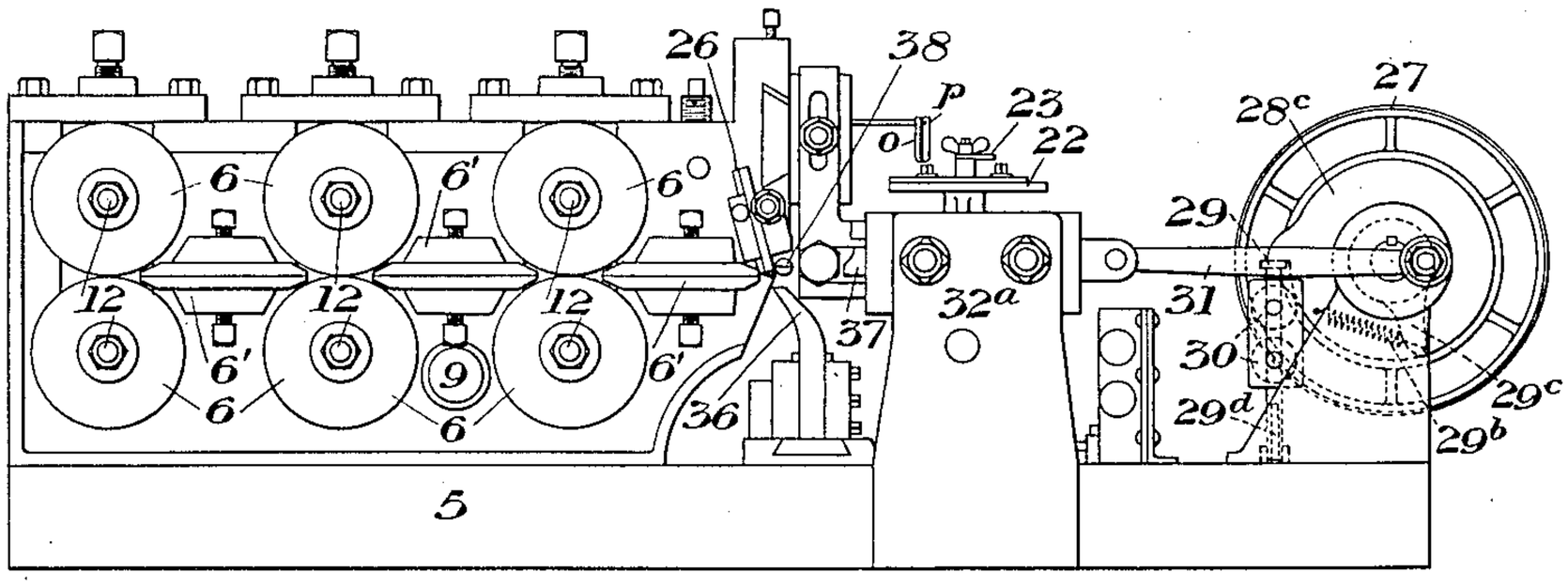
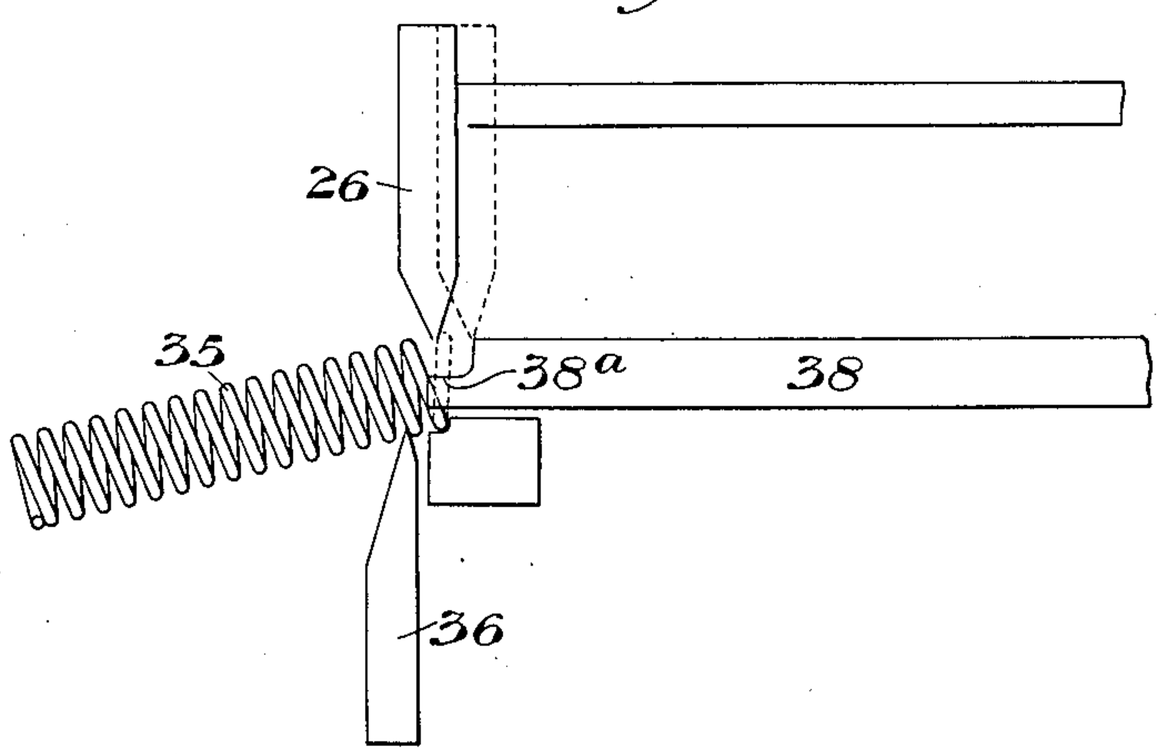



*Fig. 4.*

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4 SHEETS—SHEET 4.

Fig. 6.

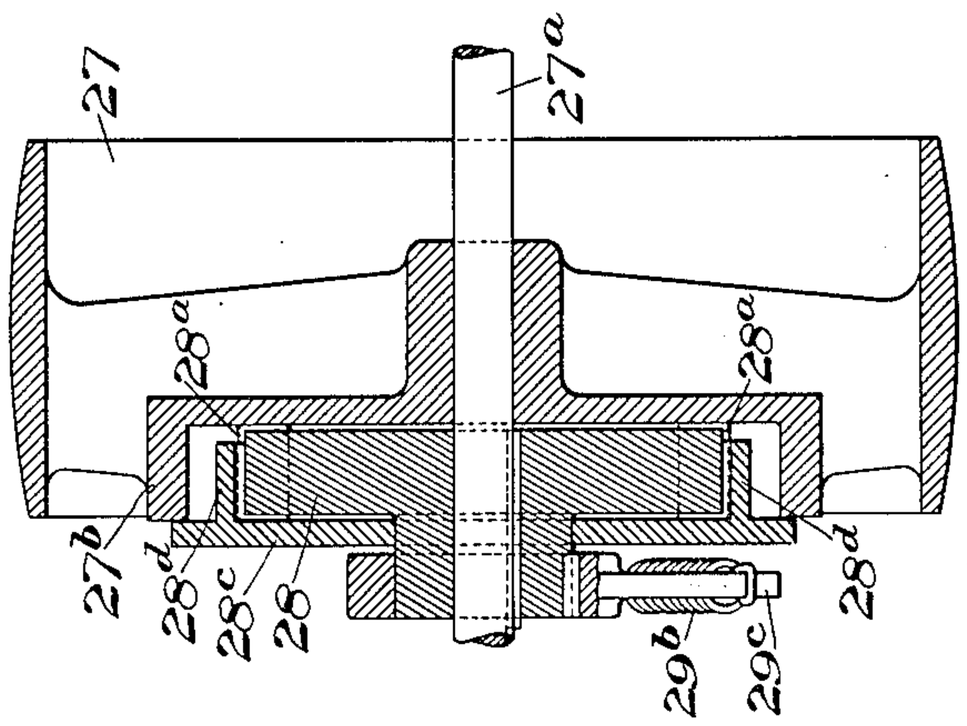
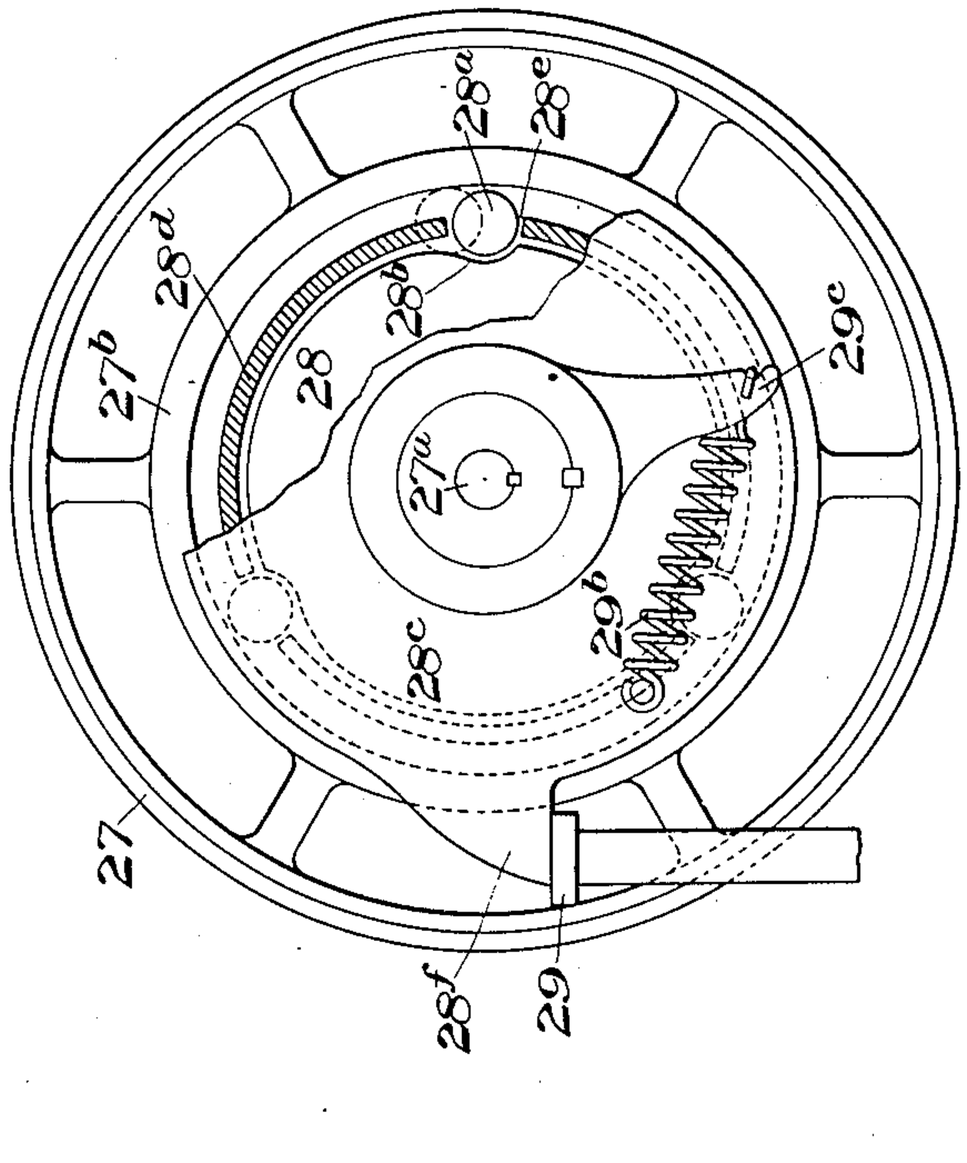



Fig. 5.

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# UNITED STATES PATENT OFFICE.

NOAH S. HARTER, OF WAUKEGAN, ILLINOIS, ASSIGNOR TO AMERICAN STEEL & WIRE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW JERSEY.

## MACHINE FOR THE MANUFACTURE OF COILED SPRINGS.

No. 882,385. Specification of Letters Patent. Patented March 17, 1908.

Application filed December 2, 1907. Serial No. 404,821.

*To all whom it may concern:*

Be it known that I, NOAH S. HARTER, of Waukegan, Lake county, Illinois, have invented a new and useful Machine for the Manufacture of Coil-Springs, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan view, partially diagrammatic, of one form of machine embodying my invention; Fig. 2 is an end elevation of the same on a larger scale; Fig. 3 is a side view of a portion of the machine; Fig. 4 is a detail view illustrating the action of the coiling, cutting and setting devices; and Figs. 5 and 6 are detail views of the cutter-operating clutch.

My invention has relation to machines for the manufacture of coil springs, and is designed to provide a machine by means of which either open or closed coil springs may be rapidly coiled, set, squared, and cut, in various sizes and lengths, by a continuous automatic operation; and which may also be adjusted so as to coil and cut springs of the desired dimensions without squaring them.

A further object is to provide a machine of this character whose adjustment to produce a spring of the desired character and dimensions is under the immediate control of the operator, the adjustable parts controlling the several adjustments being made of such flexible character that the adjustment of any one member can be quickly made without interfering with the adjustment of any other member.

My invention will be best understood by reference to the accompanying drawings, which will now be described, it being premised, however, that various changes may be made therein by those skilled in the art without departing from the spirit and scope of my invention as defined in the appended claims.

In these drawings, the numeral 5 designates the main frame of the machine which supports the operating mechanism.

6 designates a plurality of coacting feed rollers, arranged in pairs, and between which the wire 7 to be formed into springs is fed, wire guides 6′ being placed adjacent to the several pairs of these rollers.

8 is the main driving pulley, which is mounted to run freely on the shaft 9. Keyed to this shaft is a disk 10 which forms one member of a clutch within the rim of the pulley 8, said clutch being controlled by an electro-magnet 11 whose current is supplied by the circuit connections *a*, *b*. This magnetic clutch may be of any suitable or well known character, such for instance as that described and claimed in my Patent No. 870,166, dated November 5th, 1907, and need not be here described in detail. The construction and arrangement of the clutch is such that when an electric current is supplied to the magnet 11 through the circuit connections *a*, *b*, the movable clutch member controlled by the magnet will engage the fixed clutch member 10 to drive the shaft 9. Rigidly secured to the shaft 9 is a pinion $9^a$, which drives the series of rollers 6 through the gears $9^b$ mounted on the shafts 12 and stub shaft $12^b$.

The shaft 9 also carries a pinion $9^c$, which drives a train of gears 13 and 14. The gear 14 is loosely mounted on a shaft 16, and rigidly secured to the hub of this gear is a grooved disk 15 which constitutes the driving member of a ball clutch.

17 is the driven member of this clutch, which is rigidly keyed to the shaft 16.

18 is a ball, which is located between the grooved surface of the disk 15 and a plane $17^a$ which is carried by the driven member 17.

19 is a lifting device, which passes underneath the ball 18 for the purpose of holding it out of driving engagement with the disk 15 and plane $17^a$.

20 is an electro-magnet located adjacent to the ball clutch, and whose armature 21 is connected to the lifting device 19. The magnet 20 is supplied with current by the circuit connections *c*, *d* in the manner more fully hereinafter described. When this magnet is supplied with current, its armature 21 is attracted to withdraw the device 19 from beneath the ball 18, and the latter is then caused by gravity or other means to wedge itself between the face of the inclined plane $17^a$ and the groove of the clutch member 15, thereby locking the clutch.

Geared to the shaft 16 by means of the shaft $16^a$ and bevel gear wheels $16^b$, is a cam 22, $22^a$, the member $22^a$ being adjustably secured to the member 22 in order that the peripheral contour of the cam may be changed for the purpose hereinafter de-

scribed. Adjustably secured to the cam 22, $22^a$ to rotate therewith is a circuit-closing cam 23, which is designed, at a definite point in its revolution, to close the circuit between two contact devices *o*, *p*, to which are connected the circuit wires *m*, *n*.

24 is a lever pivoted to the frame at $24^a$, and whose free end is held in contact with the periphery of the cam 22, $22^a$ by the action of a spring $24^b$. Connected to the lever 24 is a rod or bar 25 around which the spring $24^b$ is coiled, and which is secured by a set-screw $24^c$. The bar 25 at its outer end carries a pitch tool 26, which determines the pitch of the coil in the manner hereinafter described.

27 is a belt-wheel, which is loosely mounted on a shaft $27^a$, and which is connected with said shaft through any suitable clutch mechanism. In the arrangement shown, this clutch consists (see Figs. 5 and 6) of a clutch-disk 28, keyed to the shaft $27^a$, and designed to be put in driving connection with the inner rim $27^b$ of the wheel 27, by the clutch rollers $28^a$. The disk 28 has the peripheral recesses or depressions $28^b$, and when the rollers lie in these recesses, the rim $27^b$ will turn freely around said disk. When, however, the rollers are moved to the position shown in dotted lines in Fig. 5, the clutch-engagement is effected. The rollers are thus moved by a loosely mounted plate or disk $28^c$, having an inwardly projecting flange $28^d$, with openings $28^e$ therein, in which the rollers $28^a$ lie. The disk is normally held in position to keep the rollers in their non-driving positions by the engagement of the lug or nose $28^f$ thereof with a movable stop 29. This stop is arranged to be withdrawn at the proper time by means of an electro-magnet 30 which is supplied with current by the circuit connections, *e*, *i*. When so withdrawn, the disk $28^c$ is rotated by a spring $29^b$ connected thereto at one end, and at the other end to an arm $29^c$ fixed on the hub of the disk 28, to move the rollers $28^a$ into clutching position. The rollers remain in this position until the stop 29 is released by the magnet, and is moved by gravity or by a spring $29^b$ back into the path of the lug $28^f$. The engagement of the lug with this stop will move the rollers out of clutching positions. Rigidly secured to the shaft $27^a$ is a crank disk $27^c$, to the crank of which is attached one end of a connecting rod or pitman 31. Connected to the opposite end of this connecting rod is a cutter bar 32 which is mounted to reciprocate under the action of the crank and pitman in the guides $32^a$.

33 is a bar which is adjustably mounted in the main frame 5, and which carries at its outer end a disk 34, which is so positioned as to be in the path of the coil as the latter moves off its forming mandrel, as shown in Fig. 1. The disk 34 is carried by a stem $34^a$, whose opposite end is adapted to make an electric contact between the two terminals *x* and *y*, to which are connected the circuit wires *e'*, *f*. The stem is normally held out of circuit closing position by a spring $34^b$.

36 is a setting tool for the purpose of removing the excess pitch from the spring as it is coiled, thus eliminating a subsequent operation for this purpose. The action of this tool is to remove the excess pitch by pressing each coil backwardly against a later coil, as more fully described in my Patent No. 873,429, of December 10, 1907.

37 is a coiling die, which is so located as to cause the wire 7 to coil around the forming arbor or mandrel 38 as the wire is fed into the machine by means of the rollers 6. This die is made adjustable towards and away from the mandrel for the purpose of varying the diameter of the coil. The end of the arbor 38 (see Fig. 4), is shaped to form a cutting edge $38^a$, which coöperates with an adjustable and interchangeable cutting tool 39 mounted at the free end of the reciprocating cutter bar 32.

40 is a friction brake for retarding the movement of the cutter actuating shaft $27^a$. 41 is a disk of fiber or other insulating material, which is rigidly secured to the shaft $27^a$ so as to turn therewith. Secured to this disk is a metallic segment 42, arranged to project beyond one face of the disk so as to come in contact with and close an electric circuit between a pair of brushes *g'*, *h'*, to which are connected circuit wires *g*, *h*. The purpose of this segment 42 is to close the circuit between this pair of brushes when the cutter shaft is not in motion, and to break the circuit at this point as soon as such shaft comes into action.

Referring now to the circuit controlling devices, for controlling the electric circuit hereinbefore referred to, B designates a battery or other source of electrical energy. 46 is a make-and-break switch, which controls the various circuits supplied by the battery.

47 is a relay having a movable armature 49 for the purpose of shifting the currents from the circuit *a*, *b*, which supplies the clutch magnet 11 to the circuit *i*, *e*, which controls the operation of the clutch 28.

48 is a circuit relay having a movable armature 50 which is for the purpose of establishing a short-circuit around the contacts *x*, *y*, as hereinafter described.

51 is a switch the purpose of which will hereinafter be described.

Assuming that it is desired to coil, set, square, and cut open coil springs, the operation is as follows:—The switch 46 is closed, which causes current to flow from the battery to the conductor *h*, to the segment 42, to the conductor *g*, to the armature 49, to conductor *a*, to clutch magnet 11, and to conductor *b* and back to the battery. The

closing of the circuit through the magnets 11 causes the clutch to lock, thereby putting into action the series of feed rollers 6 to thereby feed wire into the coiling mechanism. The wire will continue to be coiled until its outer end comes in contact with the device 34. The pressure of the coil against this device will close the circuit through the contacts $x, y$, and by way of the conductors $e', f$, to and through the switch 51 (which is in the dotted position shown in Fig. 1) to the conductor $c$, to the magnet 20, to conductor $d$, to conductor $g$, to segment 42, to conductor $h$, thus completing the circuit through the magnet 20, which throws the clutch 15, 17 into operation, which in turn causes the cams 22 and 23 to rotate. When the cams 22 and 23 commence to rotate, the coiling mechanism continues to coil, but without giving the coil any pitch. Incidentally the movement of the cam 23 closes the contacts $o, p$. This closes the circuit of the conductors, $m, n$, and also the circuit through the relay 47, which shifts the armature 49 and opens the circuit through the clutch, thereby allowing the coiler to stop. The shifting of the armature 49 closes the circuit by way of the conductor $i$ to the magnet 30, and back through the conductor $e$, thereby tripping the clutch controlling the cutter. The cutting mechanism is now thrown into action, and as soon as the cutter shaft commences to rotate, the segment 42 is moved, thereby breaking the circuit between the conductors $g, h$, which opens all the electric circuits momentarily. The opening of the circuit through the magnet 30 causes the part 29 to move back into position to throw the clutch 28 out of action as soon as one complete revolution has been made. During this time the cutting tool 39 has been actuated and a portion of the spring will have been cut off. The closing of the circuit between the contacts $x, y$ also closes the circuit through the relay 48, which shifts the armature 50 and immediately establishes a short circuit around $x, y$ which continues during the further period in which the coil is pressing against the device 34, and until the circuit is opened at the brushes $g, h$ by the rotation of the cutter actuating shaft. The purpose of short circuiting these contacts at this time, is to prevent the burning of these contacts, which would otherwise occur, due to the uneven pressure of the coil.

It will be understood in the foregoing operation that when the cam 22 has been rotated a short distance, one end of the lever 24 will swing into the low portion of such cam. This moves back the bar 25 and the pitch tool 26 carried thereby, to the position shown in dotted lines in Fig. 4. It, therefore, follows that during the time this tool is withdrawn to this position, a portion of the wire will be coiled without pitch (except the diameter of the wire). Inasmuch as the cam 22 is driven from the shaft 9, the amount of wire which is coiled without pitch will vary according to the adjustment of the adjustable portion $22^a$ of the cam 22. Sufficient wire is coiled at one operation of the cam 22 for the square on the last end of one spring and that on the first end of the succeeding spring. To accomplish this, the cam 23 is so timed as to stop the coiling mechanism and actuate the cutting mechanism to cut the wire at the middle point of the close coiled portion. If the cutter should operate too soon or too late, all that is necessary is to shift the cam 23 either to the right or to the left in order to locate the cut correctly. If more or less wire is desired for the squared ends of the springs, the movable cam portion $22^a$ may quickly be shifted backward or forward to regulate this feature for larger or smaller springs. The length of the spring may be quickly regulated by shifting the device 34 towards or away from the coiling mechanism as may be desired, while the diameter of the springs is regulated by moving the adjustable die 37 towards or away from the arbor or mandrel 38.

When it is desired to form open coil springs which are to be coiled, set and cut without squaring, all that is necessary is to move the switch 51 from the position shown in dotted lines in Fig. 1 over into contact at 52. This opens the circuit of the magnet 20 and prevents the rotation of the cams 22 and 23. The pitch tool 26 will, therefore, be held in operative position during the entire coiling operation. No other change in the parts is necessary.

To form close coiled springs, the screw $24^c$ is loosened, thereby allowing the pitch tool to be held back out of operative position. The switch 51 is left on the contact 52. To change the machine back to adapt it to square the ends of the springs, the screw $24^c$ is again adjusted and the switch 51 is shifted to its other position.

It will be obvious that various changes may be made in the machine shown and described. Thus, various forms of clutches may be employed for controlling the operation of the coiling, cutting and squaring mechanisms; those mechanisms may themselves be variously modified; and the several electric circuits and their closing devices may be arranged in any suitable manner.

The advantages of my invention result from the provision of the several mechanisms whereby the operations of coiling, setting, squaring and cutting, or of coiling, setting, and cutting, without squaring, are automatically effected, and are all performed by the same machine, thereby eliminating the separate operations. A further and valuable feature of the invention consists in the flexibility of adjustment, whereby the char-

acter of the work done, and the dimensions of the springs formed is under the control of the operator and the machine can be quickly set up for different jobs, or for springs having entirely different dimensions, without interchanging any of the parts. The entire machine is simple in its construction and operation.

I claim:—

1. In mechanism for forming coil springs, wire coiling means, an electrically controlled clutch for controlling the operation of the coiling means, a cutting mechanism, an electrically controlled clutch for controlling the operation of the cutting mechanism, controlling circuits for said clutch, and means for automatically controlling said circuits to effect the starting and stopping of the coiling means and the operation of the cutting means in proper time relation to the starting and stopping of the coiling means; substantially as described.

2. In a machine for forming coil springs, coiling means, an electrically controlled clutch for operating the coiling means, a cutting mechanism, an electrically controlled clutch for operating the cutting mechanism, and means actuated by the movement of the coil for the purpose of stopping the coiling mechanism and tripping the cutting mechanism; substantially as described.

3. A machine for forming coil springs, a coiling mechanism, electro-magnetically controlled gearing for operating the coiling mechanism, cutting mechanism, means for electrically controlling the time of operation of the cutting mechanism, and contact devices actuated by the movement of the coil as it is formed for effecting the operation of the coiling and cutting mechanisms; substantially as described.

4. In a machine for forming coil springs, a coiling mechanism, means for regulating the pitch of the coils, means for removing excess pitch from the coils continually as they are formed, and means whereby the pitch regulating device can be periodically moved into and out of operating position during the coiling operation and whereby it may be held either in or out of operative position during the coiling operation; substantially as described.

5. In a machine for forming coil springs, a coiling mechanism, a tool for regulating the pitch of the coils as they are formed, and means for periodically moving the pitch-regulating tool out of operative position and then again advancing the same, and devices for rendering the said means inoperative at will; substantially as described.

6. In a machine for forming wire coils, a coiling mechanism, a setting mechanism, a cutting mechanism, a device for automatically regulating the pitch of the coil, and means for periodically rendering said device inoperative to wind coils or turns without pitch; substantially as described.

7. In a machine for forming coil springs, the combination with a coiling mechanism, of a tool for regulating the pitch of the coils as they are wound, and cam mechanism for periodically withdrawing the pitch tool; substantially as described.

8. In a machine for forming coil springs, a coiling mechanism, a tool for regulating the pitch of the coils as they are formed, adjustable cam means for withdrawing the pitch-forming tool at a predetermined time, a cutting mechanism, and means for automatically operating the cutting mechanism in time relation to the operation of the cam mechanism; substantially as described.

9. In a machine for forming coil springs, a coiling mechanism, a tool for regulating the pitch of the coils as they are formed, cam means for periodically withdrawing the pitch tool and then again advancing the same, and means for rendering the cam mechanism inoperative; substantially as described.

10. In a machine for forming wire coils, a coiling mechanism, a tool for regulating the pitch of the coils as they are formed, and means for periodically advancing and retracting the pitch regulating tool into and out of operation; substantially as described.

11. In a machine for forming wire coils, a coiling mechanism having means for regulating the diameter of the coils, a tool for regulating the pitch of the coils, a cutting mechanism, electrically controlled clutches for controlling the operation of the coiling and cutting mechanisms, controlling circuits for said clutches, and circuit closing devices operated by the movement of the formed coil to first stop the coiling mechanism and subsequently start the cutting mechanism; substantially as described.

12. In a machine for forming coil springs, a coiling mechanism, an electro-magnetically controlled driving clutch therefor, a cutting mechanism, an electro-magnetically controlled driving clutch for the cutting mechanism, a pitch-regulating device, and means operated by the movement of the formed coil for stopping the coiling mechanism and actuating the cutting mechanism; substantially as described.

13. In mechanism for forming coil springs, a coiling mechanism, a pitch regulating tool, a controlling device for moving said tool into and out of operative relation to the coiling mechanism, and means controlled by the formed coil for first causing the movement of the said tool to an inoperative position and for subsequently stopping the coiling mechanism; substantially as described.

14. In a machine for forming coil springs, a coiling mechanism, a tool for regulating the pitch of the coils as they are formed, an adjustable cam mechanism for advancing and

retracting the pitch-regulating tool, and a device operating in time relation to the cam mechanism for controlling the stopping of the coiling mechanism; substantially as described.

15. In a machine for forming wire coils, a coiling mechanism, an electro-magnetically controlled clutch for controlling the operation of the coiling mechanism, a contact device located in the path of the formed coil, a pitch regulating tool, a cam for controlling the operative position of said tool, means controlled by the contact device for controlling the operation of the cam, a device operating in time relation to the cam for controlling the stopping of the coiling mechanism, a cutting mechanism, and means for automatically operating the cutting mechanism when the coiling mechanism stops; substantially as described.

16. In a machine for forming coil springs, coiling means, a contact device located adjacent to the coiling means and arranged to be engaged by the formed coil, contacts and connections causing the engagement of said coil with said device to control an electric circuit, and means for short-circuiting the contacts closed by said devices as soon as the last-named circuit has been closed; substantially as described.

In testimony whereof, I have hereunto set my hand.

NOAH S. HARTER.

Witnesses:

ARTHUR C. WARD,

W. D. WHYTE.