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P. CUCHERAT.
Coil-Spring Machine.

No. 206,300. **Patented July 23, 1878.**

Fig. 1

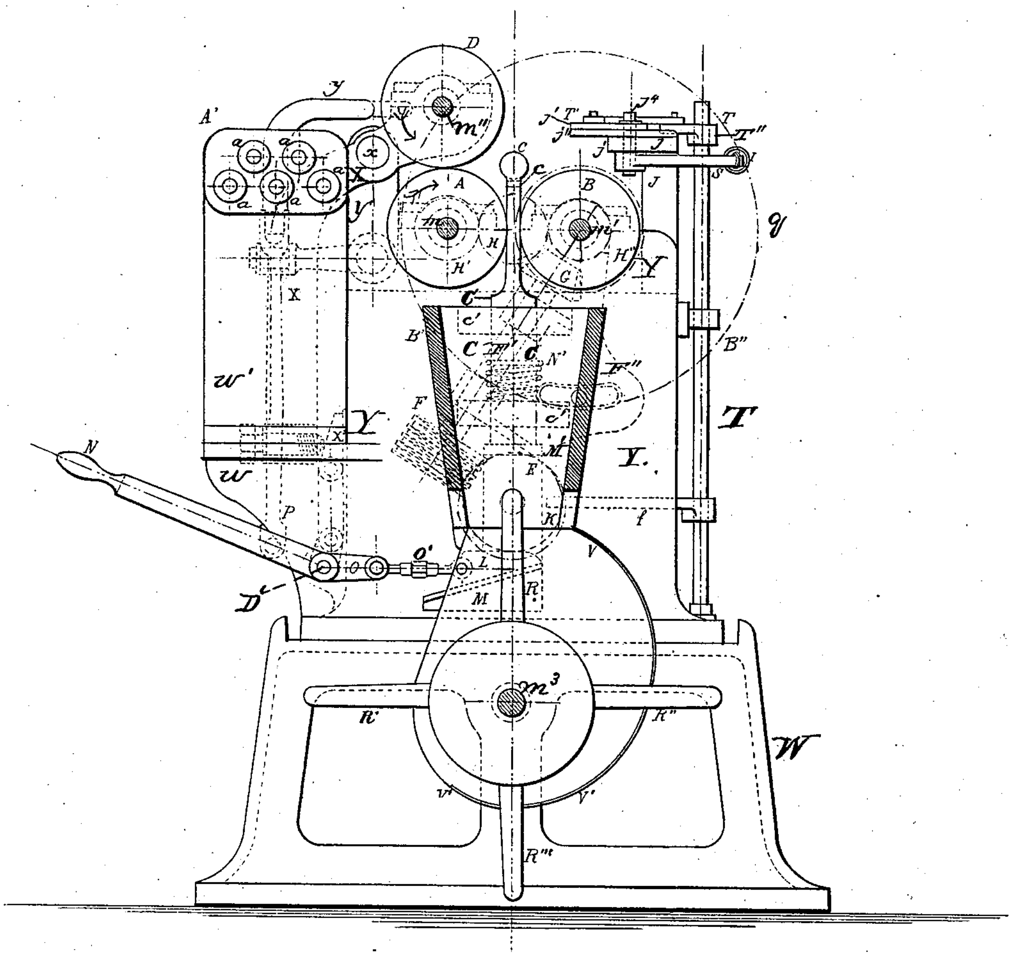

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Fig. 2

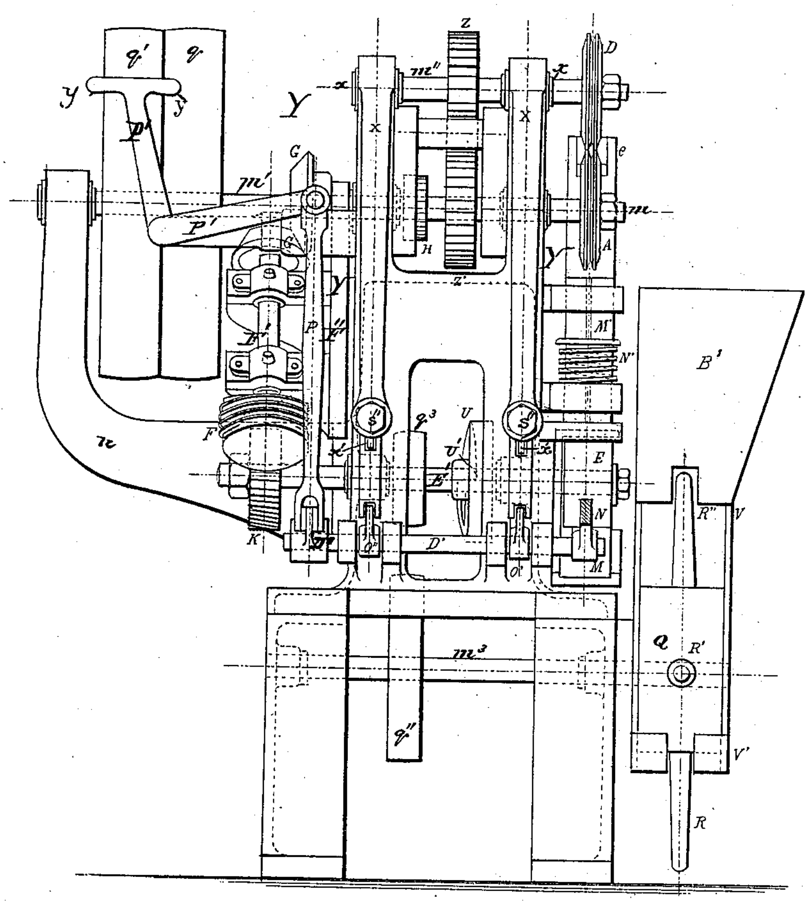

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Fig. 3

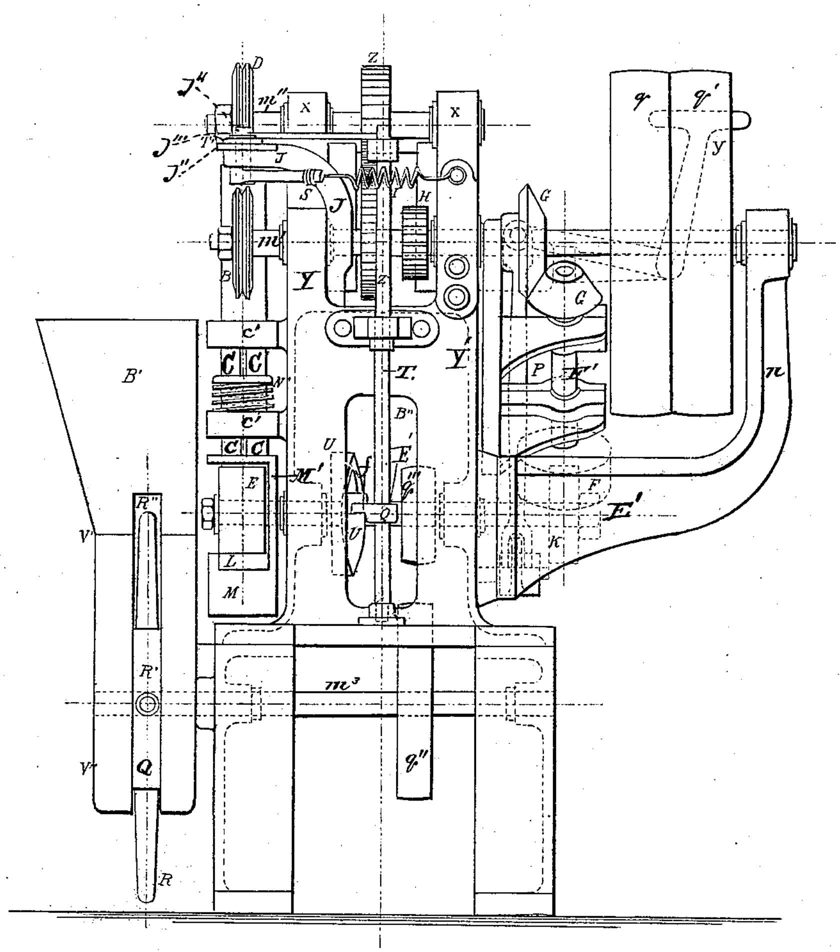

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Fig. 4.

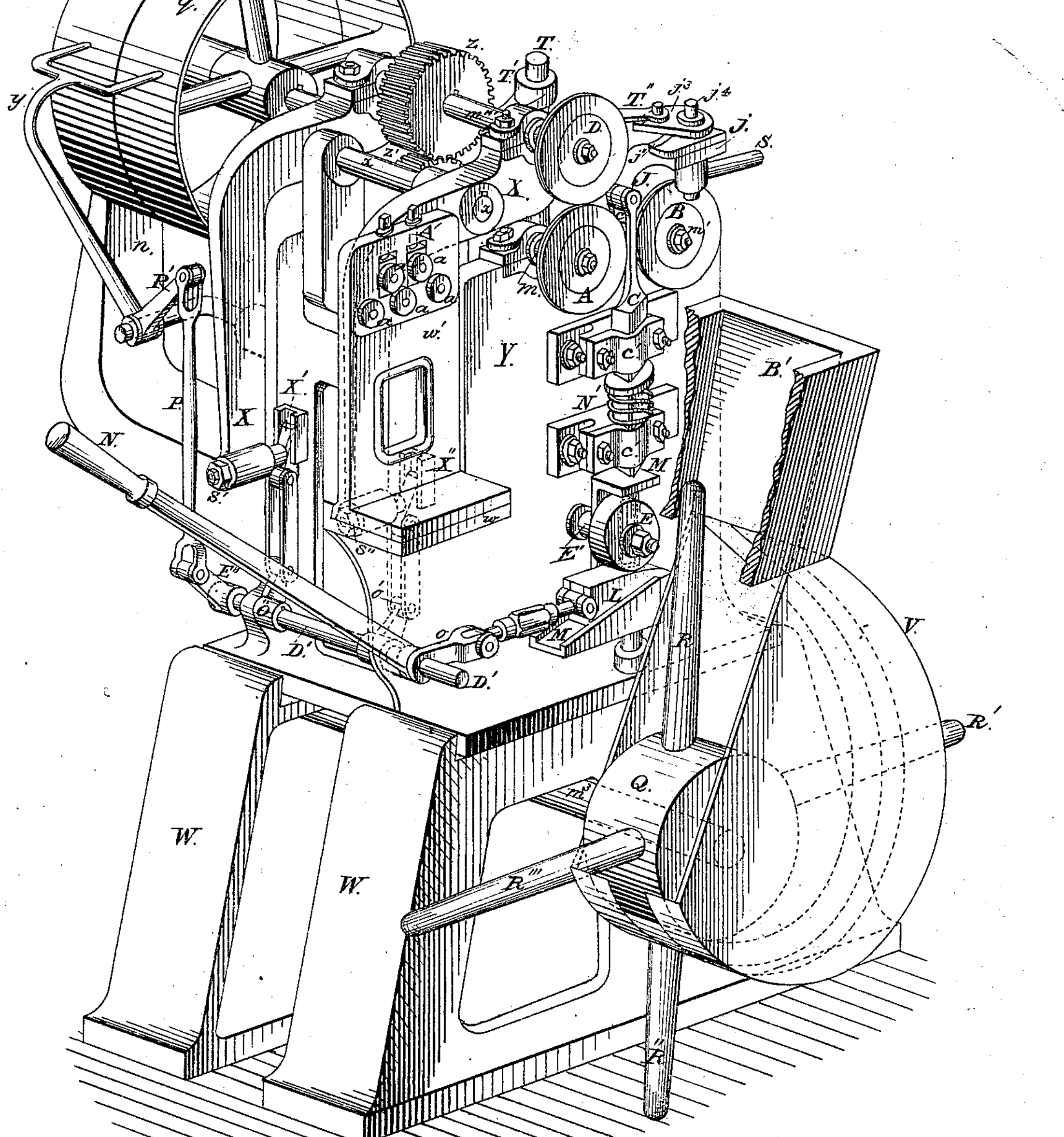

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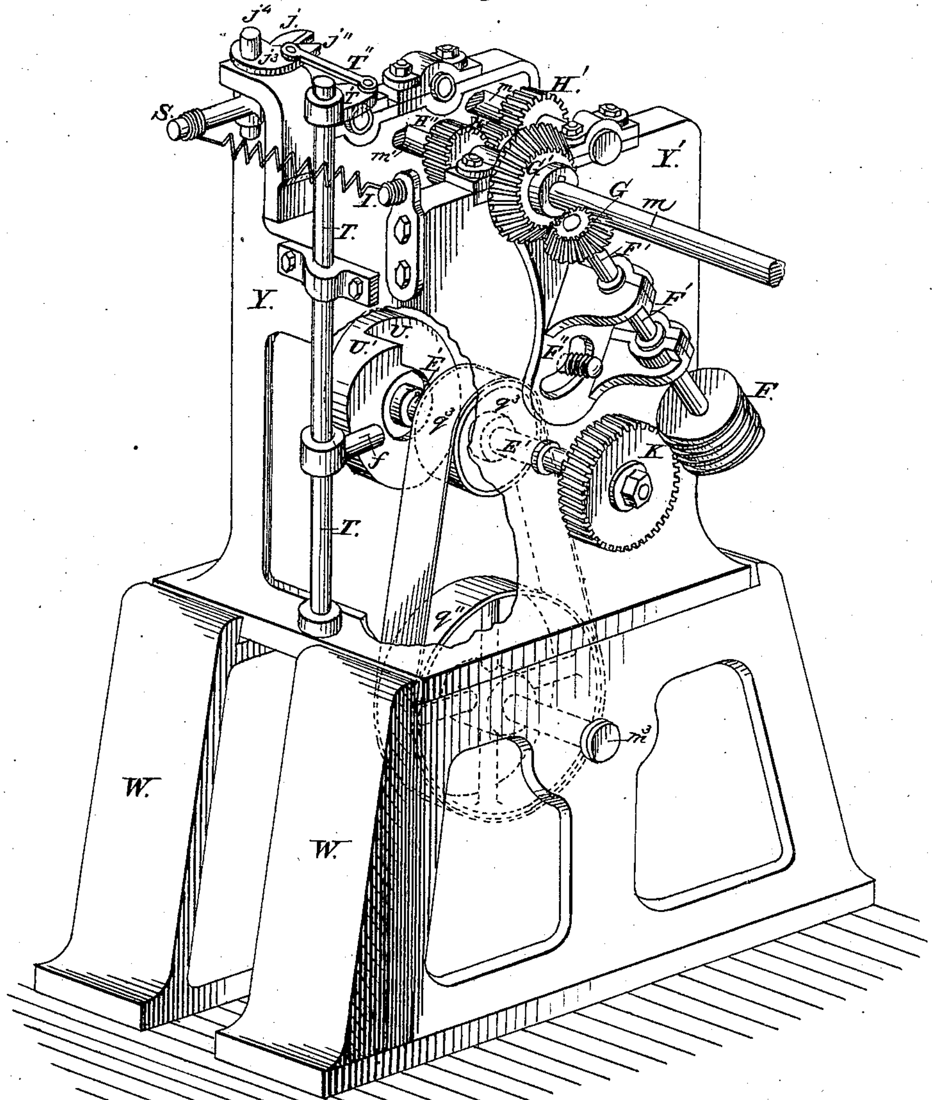
Fig. 5.



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UNITED STATES PATENT OFFICE.

PAUL CUCHERAT, OF LYONS, FRANCE.

IMPROVEMENT IN COIL-SPRING MACHINES.

Specification forming part of Letters Patent No. **206,300**, dated July 23, 1878; application filed October 24, 1877.

To all whom it may concern:

Be it known that I, PAUL CUCHERAT, of Lyons, France, engineer, have invented a new and useful Machine for making Metal Springs, which machine is fully set forth in the following specification, reference being had to the accompanying drawing.

My invention relates to a machine for forming spiral springs from wires or rods of metal by subjecting such wires or rods, after straightening, to continuous flexion in the same direction and beyond the limit of elasticity of the metal as the wires or rods pass longitudinally under the action of the bending-tool, being at the same time supported at both sides of said tool.

The forming of springs by my machine is a continuous operation, each rod or wire, or given length thereof, from which a spring is formed being subjected to precisely the same action of the straightening, coiling, severing, and compressing devices as all other rods or wires, or given lengths thereof, which pass through the machine at the same adjustment, and before one spring completely finished falls out of the machine another is, or others are, in process of formation by the same devices and following the same path.

My invention consists, first, in an improved combination of rod or wire supports and an intermediate reciprocating standard, which acts upon the rod or wire to produce successive flexures or bends thereon between said supports as said wire or rod passes continuously from one to the other; second, in an improved combination of devices for actuating a severing apparatus, arranged directly over the second rod or wire support, from which the coiled spring passes between the cutting-blades, and is by them cut into required lengths; third, in a compressing device, consisting of a circumferentially-slotted drum, arranged eccentrically around a rotary hub provided with spokes, which play through the slot in the drum, which is provided with a hopper, into which each spring falls as severed, and is caught upon one of the said arms and forced around through the gradually-narrowing chamber of the eccentric-drum, and finally expelled therefrom at its most contracted part, on emerging from which the spring has undergone the required compression, and drops from the arm which carried it; fourth, a combination of engaging and disengaging devices, by means of which the principal operative parts of the machine may be simultaneously thrown in or out of action.

It consists, besides, in certain connecting and adjusting devices, which, together with the various details of construction involved in my invention, will be hereinafter described and the operation thereof explained.

In the drawings, Figure 1 is a side elevation of my spring-forming machine, showing the devices for straightening the rods or wires preparatory to the coiling, the coiling and severing devices, and the compressing drum and arms; also a portion of the disengaging and adjusting devices. Figs. 2 and 3 are opposite end elevations of the machine. Figs. 4 and 5 are two opposite perspective elevations, showing each two sides, and, through large cuts, the interior of the machine.

From the suitably-formed base W rise broad standards Y Y′, connected together by cross-beams, and upon a bracket, *w*, projecting from the standard Y is arranged a standard, *w′*, which supports a wire or rod straightening device, A′, consisting of the small grooved wheels or rollers *a*, which should be arranged so close together as to oppose a considerable frictional resistance to the passage of a bar or wire longitudinally between the upper and lower rows thereof.

In practice, the upper row of wheels should be vertically adjustable, in order to accommodate wires and rods of various diameters.

A is a larger grooved wheel, mounted upon the projecting end of a shaft, *m*, journaled in suitable bearings upon the standards Y Y′, and having its upper edge in the same horizontal plane as the upper edges of the lower row of small rollers *a*.

B is a wheel in all respects similar to A, and mounted in the same horizontal, and turns in the same vertical, plane therewith upon a shaft, *m′*, as shown, but may be arranged in another vertical plane for a purpose hereinafter explained. The shaft *m′*, besides its bearings in the standards Y Y′, extends to, and has bearings in, the upper end of an arm or bracket, *n*, and upon this part of said shaft are mounted the fast and loose pulleys *q* and *q′*.

D is a wheel similar to A and B, and is

mounted upon the projecting end of a shaft, m'', which is journaled in movable bearings in the ends of bent levers or arms X X, pivoted at x x in upward projections from the standards Y Y′, and extending downward to near the base W. Between the grooved wheels A and B stands a vertical standard or tool, C, having in its upper end a suitable aperture, c, cut in the direction of the rotation of the wheels. This standard or tool has an enlarged lower portion, extending downward through guides c' c', and resting upon and firmly secured to a frame, M′, open outward and at its sides, and arranged to move vertically. The bottom of the frame is an inclined or wedge-shaped block, M, upon which rests the inclined face of another block, L, arranged to slide thereupon. Between the block L and the top of the frame M′ revolves a smooth-faced eccentric, E, or a cam, mounted upon a shaft, E′, having bearings in the standards Y Y′. The rear wall of frame M has a vertical slot, through which the shaft E′ passes. The shaft E′, when revolving and by means of the cam E, the block L, and the frame M M′, causes to mount and descend the standard or tool C, according to the form of the said cam E. The wires or rods, which are drawn by the wheels A and D until they pass between them, will be pushed forward after having passed, in consequence of their rigidity, and passing through the aperture c of the tool under the friction-roller on its top, and being on the other side supported by the wheel B, they will be bent by continuous pressure of the upper wall of this aperture c. Accordingly to the position of the points of contact of the wires or rods on the wheels A and B and through the aperture c at the top of C, the flexure given to the wires or rods will be more or less.

Shaft E carries on the projecting end an oblique-toothed gear-wheel, K, which meshes with a worm-wheel, F, upon the end of a swinging shaft, F′, which has upon its upper end a bevel-gear wheel, G, meshing with a corresponding gear, G′, mounted upon the main driving-shaft m', mounted upon bearings located in the standards Y Y′.

A counter-shaft, journaled in bearings upon standards Y Y′ between the bearings of shafts m and m', carries a gear-wheel, H, which meshes with similar wheels H′ H″, mounted upon shafts m and m', and shafts m and m'' also carry gear-wheels l l', meshing together at the proper time.

Thus far I have described the devices and arrangements thereof essential to the proper introduction of a wire or rod into the machine and coiling it into spiral form, and their operation is as follows: A rod or wire is placed between the rows of rollers a, fed between wheels A and D through aperture c of standard or tool C, and its end resting upon wheel B. Power now being applied to pulley g by means of a belt, rotary motion is communicated from shaft m' through gear-wheels H, H′, H″, and Z Z′ to wheels A D B, and through bevel-gears G G′, worm-wheel F, and oblique-toothed wheel K to the shaft E′ and eccentric E, which, by its revolutions, more or less slow, (this eccentric having only to make one turn while the whole length of a spring passes between the wheels A and D,) communicates a vertical reciprocating motion to the standard C. The extent and rapidity of this motion are relative to the form of the springs to be made. For each form, different in diameter of coils, the eccentric-cam E has to be adjusted differentially in its form and eccentricity.

The wheels A and D clamping the wire or rods tightly between them, owing to the pressure exerted by adjusting-screws s'' s'' in the lower ends of levers or arms X X′, said rod or wire is drawn from between the rows of rollers a straightened and somewhat laminated, and as it passes through the aperture c in standard C, its end being supported by wheel B, it is subjected to downward flexure, which should extend beyond the limit of elasticity of the rod, so as to cause a permanent curve.

To form springs of given form and size, I proceed as follows: First, I measure the length of wire contained in such a spring. Suppose it will be four meters; suppose, also, that the wheels A, B, and D have a diameter such as to make pass forty centimeters of wire or rod at each turn of them, or the four meters necessary in making ten turns. While they make these ten turns the cam or eccentric E shall make only one turn. For that purpose the oblique-toothed wheel K, which meshes with the worm-wheel F, must have the number of teeth necessary to make the shaft E, which may be called the "shaft of unities of the springs" or "wire-length-measuring shaft," turn one time while the different lengths required for each shape of springs pass between the wheels A and D. Therefore it is necessary to have wheels K of different diameters.

To make cylindrical springs, the smooth-faced wheel or cam E must be round, so as to hold the tool C always in the same position in regard to the points of support of the wire or rod on the wheels A and B. According to the diameter of the cylindric springs to be made, the position of the tool C is regulated by the diameter of the round wheel E combined with the position more or less advanced of the wedge L in the frame M′.

If the shape of the springs to be made is that of two cones hanging together by the large or the small ends, the tool or cylinder C must make complete evolution—that is, mount and descend or descend and mount—while the length of wire or rod required for one spring passes between the wheels A and D, and therefore the eccentric form of the wheel E is then necessary. If the two cones hang together by their small ends, the tool C is made to descend by the eccentric E during the time necessary to make the first half of the spring, and during the forming of the second half the tool C is made to mount by the combined action of eccentric-wheel E and the spring N′, which has been placed around the tool, one end being fixed to this tool, and the other bearing on a suitable point of the permanent part of the machine-frame to sustain it and make it follow perfectly the eccentric-wheel E in all its curves, this being essential to convenient working.

It will be desirable at certain times to cut the springs in given lengths, or into their unities if they are not cylindric springs, which are usually formed of any length convenient for handling, and afterward cut up for special purposes. For this purpose I place upon my machine a cutting apparatus, which I will now describe.

J is a vertical arm, having a horizontal arm, j, to which is rigidly secured a shear-blade, j'', and upon top of this blade is pivoted another shorter blade, j^3, by means of a short shaft, j^4, passing through arm j, its upper end squared to fit a hole in the upper blade, and its lower end squared to fit a socket in the end of an arm, S, to the outer end of which is attached a spring, I, the other end of which is fixed at a suitable point to a permanent part of the machine-frame. T is a vertical shaft, arranged in suitable bearings at the end of the machine, and from its upper end projected an arm, T′, the outer end of which is connected by a link, T″, with the pivoted blade j''.

From near the foot of the vertical shaft T an arm, f, Fig. 5, projects across the cam-face of a wheel, U, mounted on a shaft, E′. The face of the wheel is a curved inclined plane, which, as the wheel turns, forces the arm f to one side, turning the shaft T, so as to open the shears and cause a considerable tension in spring I, while the shoulder U′, or highest point of the inclined cam-face of wheel U, passes arm f, which will then be released and fly back, permitting the spring I to forcibly and suddenly close the shears upon the coil, which should be guided between the blades. The shears should be arranged immediately over the wheel B, and when the first coil or spring has been once guided between the blades it will continue to travel in that direction.

In practice, the fitting of the cam U on the shaft E′ must be regulated, once for all, so as to make it act on the shoulder U′ in the moment after the cam E ended its rotation necessary to form one spring, and made the tool or cylinder C begin another vertical reciprocating motion necessary to form the next spring.

As said before, the shaft E′ will make one turn while the length necessary of wire or rod for one spring passes through the machine, and the position where the spring is cut off is determined by the angle of fitting of the cam U in regard to the cam E.

As to the rapidity of motion of shaft E′, and therefore of cams or wheels E and U, it is regulated, as beforesaid, in conformity to the lengths of wires or rods contained in one spring by means of the worm-wheel F and the oblique-toothed wheel K, which can be changed for others of more or less large diameters.

It will usually be the case that the spring which has just been coiled and cut will have to be upset or compressed, and for the purpose I attach to and combine with the other parts of my machine an apparatus described as follows:

A shaft, m^3, arranged in bearings in the side of the base W, has on its projecting end a hub, Q, from which, in the same vertical plane at right angles, project four radial arms, R R′ R″ R‴. A drum, V, placed eccentrically around this hub, is surmounted by a hopper, B′, Fig. 4; and said drum has, through the entire extent of the curved wall an aperture or slot, through which the radial arms R R′ R″ R‴ play. The shaft m^3 carries a belt-pulley, q'', Fig. 5, and receives motion from another belt-pulley, q^3, on the shaft E. These pulleys should be so proportioned that one of the arms R R′ R″ R‴ will be brought to a vertical position in the hopper B′ just at the moment a spring is severed from the coil by the cutting device hereinbefore described. In this case the proportion of speed between shaft E′ and shaft m^3 of the compressing apparatus is of one to four. The severed spring will fall into the hopper and around the vertical arm, which, continuing its revolution, will force said spring around through the gradually-contracting chamber of the drum until it finally passes out from the most contracted part, and drops from the arm which carried it. But it is not always necessary that the springs should be compressed, as they may be found to have, when cut off, the exact required pitch or distance between spirals; for, as before intimated, the wheel B may be placed in a different vertical plane from A and B, and the wire may pass obliquely from A and D to B, and the degree of angle which it thus forms with the plane of wheel A will determine the pitch of the spring formed, the distance between the spirals of which will correspond with the angle.

I will now describe the combination of engaging and disengaging devices, by means of which the principal operative parts of the machine may be simultaneously thrown into or out of action.

A lever, N, is fixed upon a shaft, D′, from which project also short arms O, O′, O″, and E″. The shaft D′ is turned by the lever, and through arm O and an adjustable connecting-link sliding motion is communicated to the block L on the inclined face of the block M. When the block L is moved from beneath the eccentric E the spring N raises the standard C, so that the eccentric may revolve without communicating motion to frame M or cylinder C, the aperture c of which will be at or above a tangent line between wheels A and B, so that the rod or wire may be readily removed from or passed through said aperture. At the same time the arms O and O″, through connecting-links, move the wedges X′ X″, arranged between the ends of arms X X and the permanent frame of the machine, the withdrawal of which wedges, as will be seen, relieves the rod or wire from pressure between wheels A and D. The arm E″, through link P and lever P′, operates the fork *y* for shifting the belt from the fast to the loose pulley.

The connecting-links from the arms on shaft D′ may be so arranged that a movement of the lever N in either direction will throw the parts out of action; or they may be so arranged that a movement of the lever in one direction will throw the parts into action, and a movement in the opposite direction will throw them out.

The shaft F′, Fig. 5, of the worm F has its bearings on a swinging frame, F″, so arranged that at any moment the worm F may be swung out of engagement with the oblique-toothed wheel K, if this wheel is to be changed to make springs of different shape, or for other reasons.

The advantage of the combination of disengaging and engaging devices is, that immediately on the stoppage of the machine the parts which act directly upon the rod or wire are placed in such positions that the said rod or wire may be readily removed therefrom or placed in proper position for being acted upon, as desired.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination of the wheels A B, the vertically-reciprocating standard C, having the guide passage or aperture *c* at its upper end, substantially as and for the purpose set forth.

2. The combination of vertical shaft T, arm *f*, cam-faced wheel U, spring-shears, and connecting arms and links, substantially as set forth.

3. In a spiral-spring machine, an automatic compressing device, provided with arms for receiving the separate coils as completed, and for forcing them through a compressing-drum, substantially as described.

4. The combination of revolving hub Q, having radial arms R R′ R″ R‴, and the slotted eccentric-drum V, substantially as described.

5. In a spiral-spring machine, the combination of the main driving-shaft and the coiling and straightening devices with devices for throwing said driving-shaft coiling and straightening devices out of or into action and operative engagement simultaneously, substantially as and for the purpose set forth.

6. The combination of lever N, shaft D′, arms O O′ O″ E″, wedges L X′ X″, levers X X, fork *y*, and intermediate links, substantially as and for the purpose set forth.

7. The combination of the driving-shaft *m*, swinging shaft F′ and intermediate gears, worm-wheel F, oblique-toothed wheel K, shaft E′, and a variable device for lifting the standard C, substantially as described, and for the purpose set forth.

8. The combination of the main driving-shaft and the coiling devices with the shaft F′ of the worm-wheel F, cams E and U on shaft E′, and the oblique-toothed wheel K, substantially as described.

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