(No Model.) 4 Sheets—Sheet 1.

H. S. HALL.

MACHINE FOR COILING WIRE.

No. 260,752. Patented July 11, 1882.

Fig. 1.

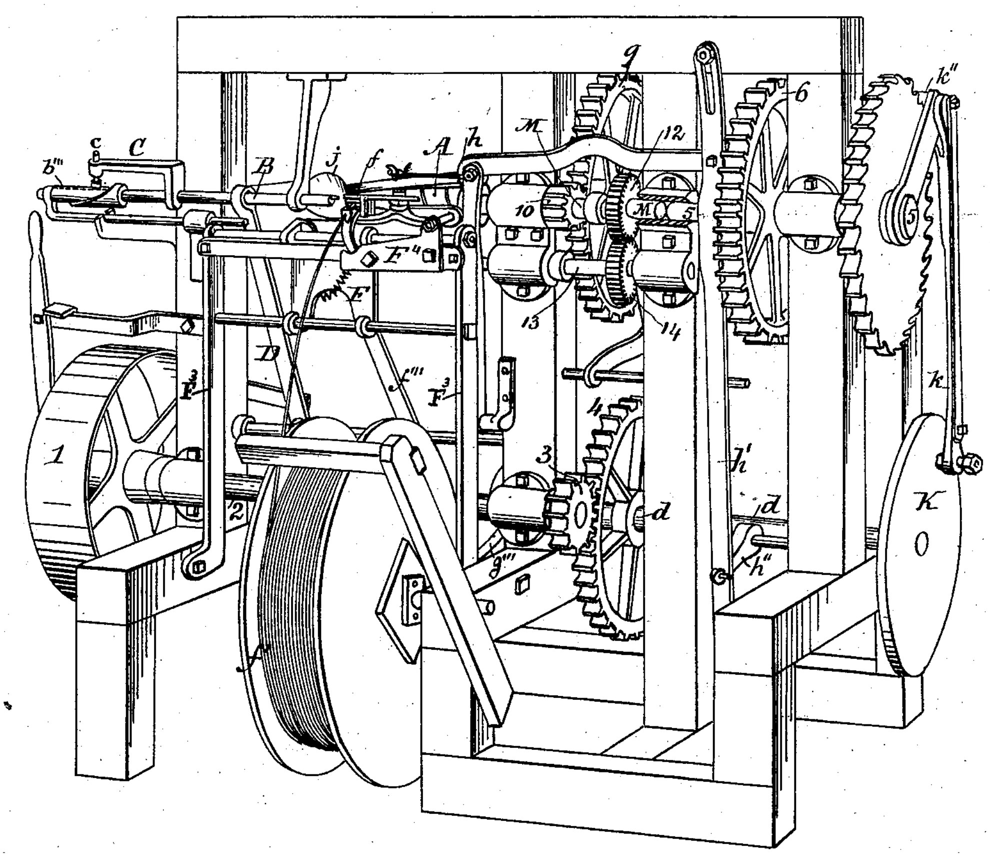
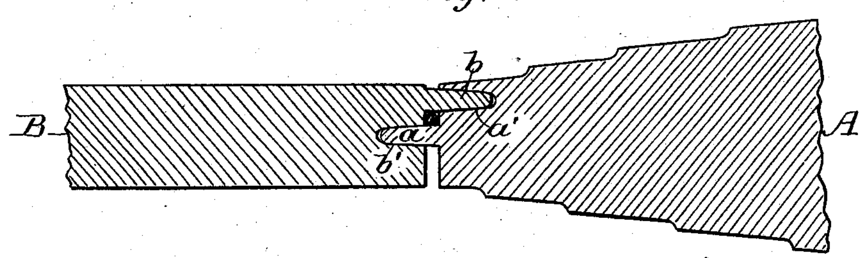


Fig. 2



Witnesses:

W. B. Masson

C. C. Shepherd

Inventor:

Hiram S. Hall

by E. E. Masson

associate atty.

(No Model.) 4 Sheets—Sheet 2.

H. S. HALL.

MACHINE FOR COILING WIRE.

No. 260,752. Patented July 11, 1882.

Fig. 3.

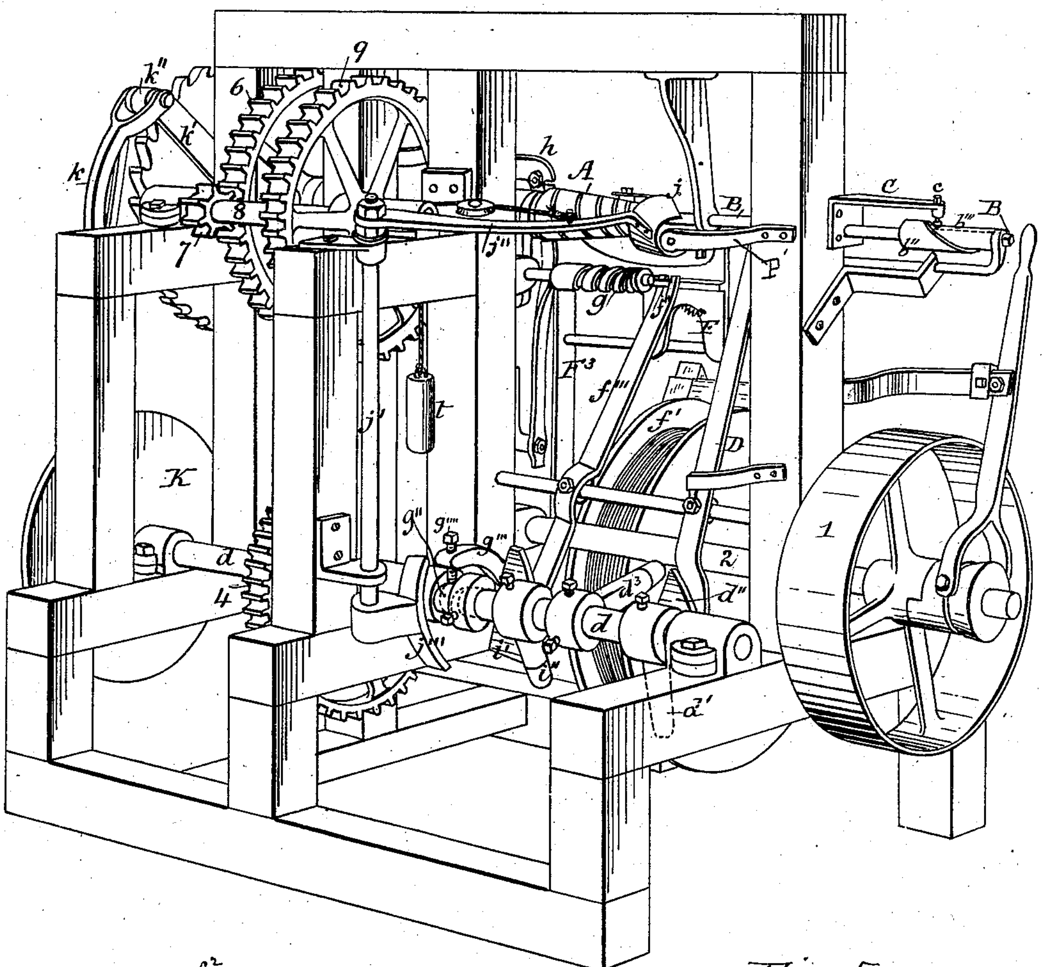


Fig. 4.

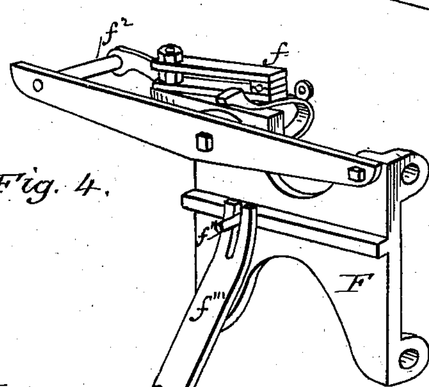
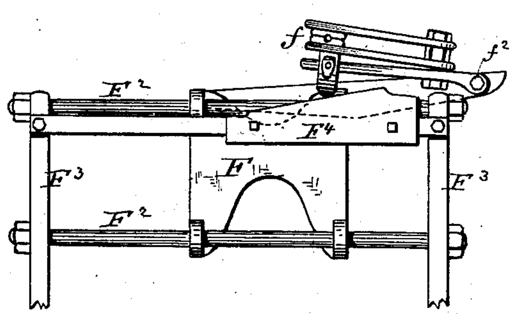


Fig. 5.



Witnesses:

W. B. Masson

C. C. Shepherd

Inventor:

Hiram S. Hall

by E. E. Masson

associate atty.

(No Model.)

4 Sheets—Sheet 3.

H. S. HALL.

MACHINE FOR COILING WIRE.

No. 260.752.

Patented July 11, 1882.

Fig. 6.

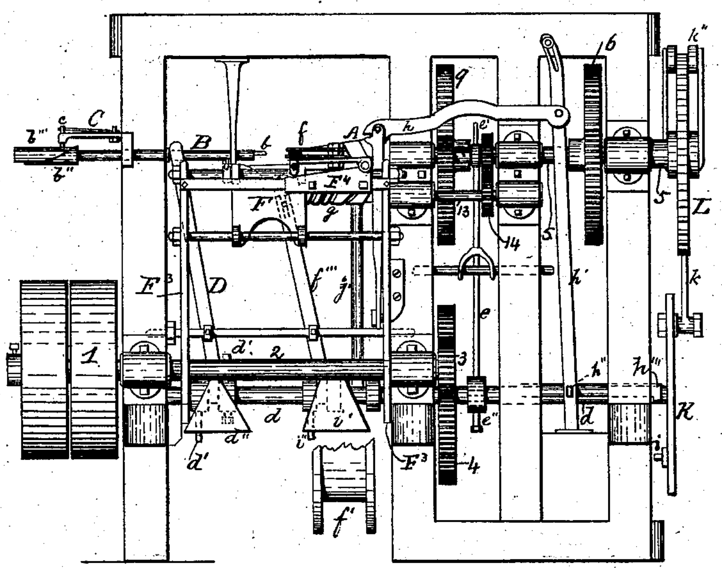
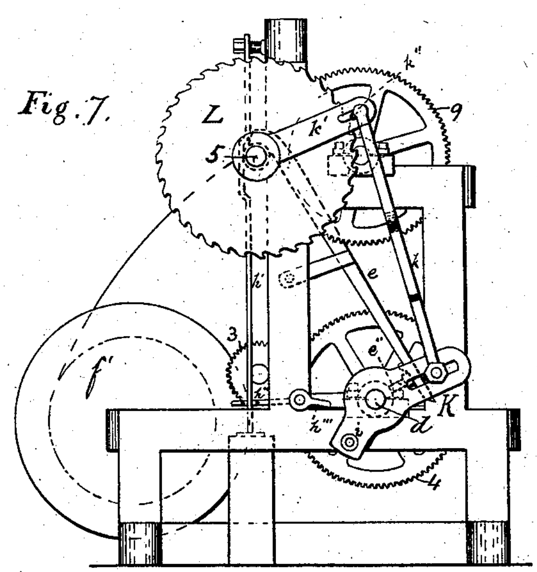


Fig. 7.



Witnesses:

[signature]

Porter Sheldon

Inventor:

Hiram S Hall

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 4.

H. S. HALL.

MACHINE FOR COILING WIRE.

No. 260,752. Patented July 11, 1882.

Fig. 8

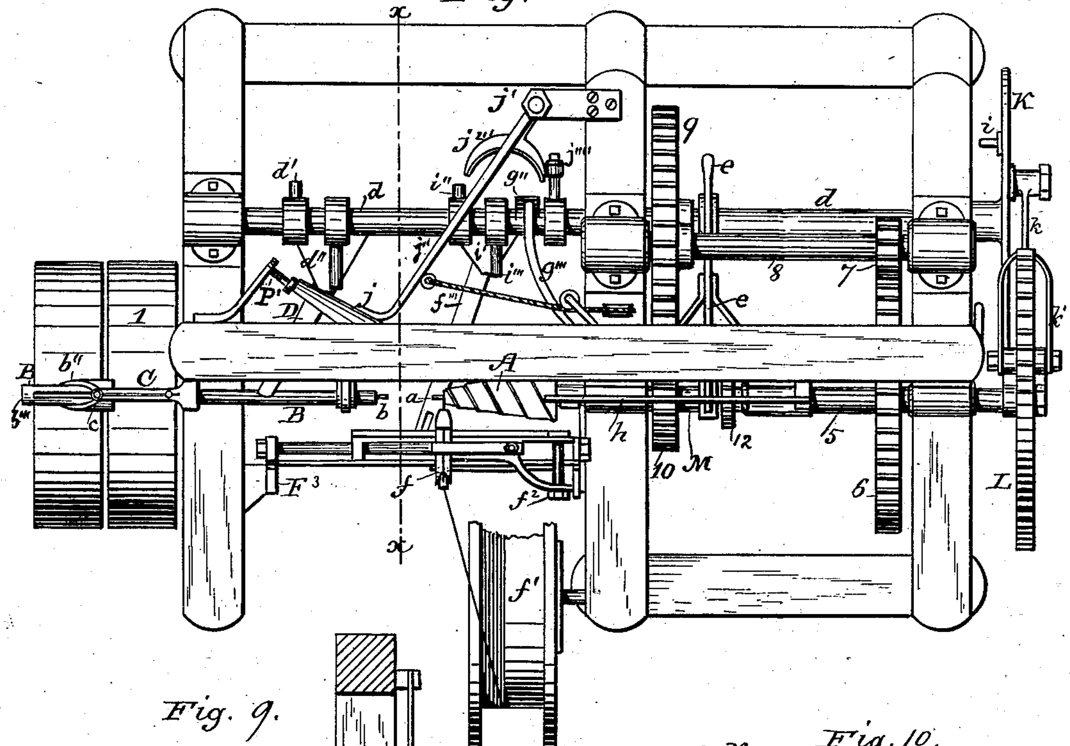


Fig. 9.

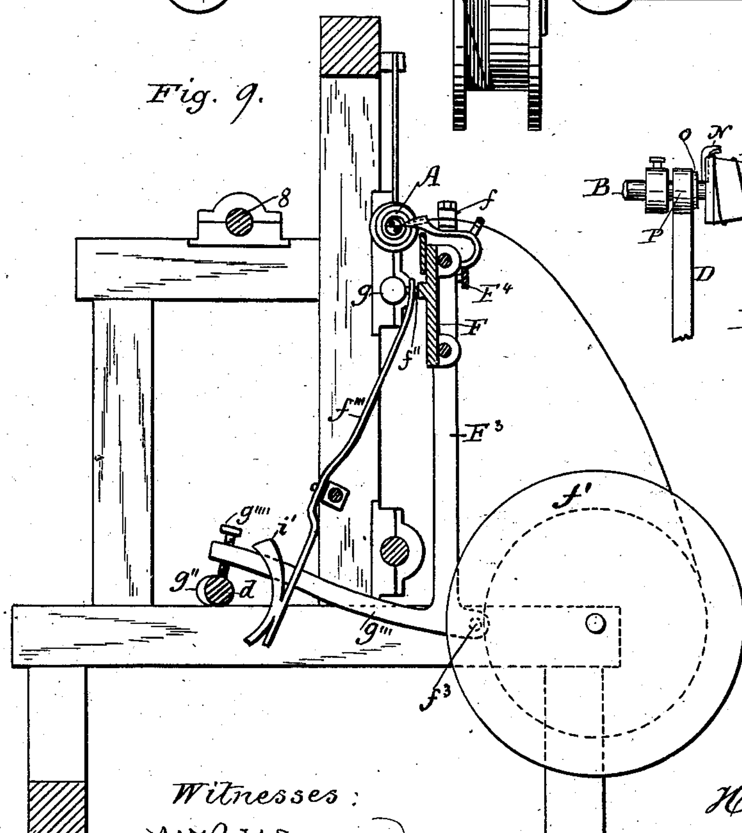


Fig. 10.

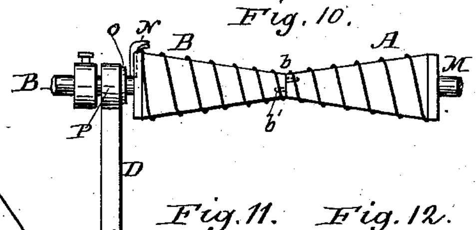


Fig. 11.

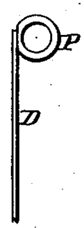
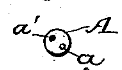


Fig. 12.



Witnesses:
W. B. Masson
C. C. Shepherd

Inventor:
Hiram S. Hall
by E. E. Masson
associate atty.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

HIRAM S. HALL, OF JAMESTOWN, NEW YORK.

MACHINE FOR COILING WIRE.

SPECIFICATION forming part of Letters Patent No. 260,752, dated July 11, 1882.

Application filed June 22, 1881. (No model.)

To all whom it may concern:

Be it known that I, HIRAM S. HALL, of the village of Jamestown, county of Chautauqua, and State of New York, have invented a new and useful Improvement in Machinery for Manufacturing and Forming Spiral Coiled Wire Springs, both single and double cone shaped, of which the following is a specification.

Figure 1 is a front perspective of the machine. Fig. 2 is a longitudinal sectional view of a portion of the spring-forming cone and locking-shaft, showing a cross-section of the wire from which the spring is to be formed. Fig. 3 is a rear perspective of the machine. Fig. 4 is a perspective view of the wire-feeding carriage and its guiding-arm. Fig. 5 is a front elevation of the wire-feeding carriage and its feeding-arm with a portion of the frame supporting and guiding said carriage. Fig. 6 is a front elevation of the whole machine. Fig. 7 is an end elevation of the same. Fig. 8 is a plan of the machine. Fig. 9 is a vertical section of the same, taken on line *x x* of Fig. 8. Fig. 10 is a front elevation of a mandrel or former for a double-cone spring. Fig. 11 is an end elevation of the shifting-arm of the last-named device, and Fig. 12 is an end view of the small end of the forming cone or mandrel.

Said improvements relate, first, to the holding or locking of the end of the wire from which the spring is to be formed to the end of the cone over which it is to be formed. In the drawings, Fig. 2, A is the cone, having in its end a projecting pin, *a*, and a recess, *a'*. B is the locking-shaft, having in its end a projecting pin, *b*, and a recess, *b'*. When the ends of the cone and locking-shaft come together the pin in the cone enters the recess in the locking-shaft and the pin in the locking-shaft enters the recess in the cone. The end of the wire from which the spring is to be formed is placed, by a movement hereinafter described, upon and at right angles to the pin *a* in the end of the cone, the extreme end of the wire extending a short distance beyond said pin. The locking-shaft B is then thrown forward against the end of the cone, the pin *b* in the end of the locking-shaft entering the recess *a'* in the end of the cone above the wire, and the pin in the end of the cone on which the wire rests entering the recess *b'* in the end of the locking-shaft B, the wire being thus firmly held between the ends of the locking-shaft and the cone laterally, and being also held from above and below by the pins *a* and *b*. Upon the cone commencing its revolution, the wire end is formed into a half-loop around the lower pin, and there firmly held while wire sufficient to form the spring is wound up along the surface of the revolving cone.

Second. The locking-shaft B (see Figs. 1 and 3) is held in position for its pin *b'* to enter the recess in the end of the cone A, and to receive the cone-pin *a* into its recess *b'* by means of the guide-pin *c*, supported by the guide spring and arm C in the guide-slot *b'''*, which runs along the top of the locking-shaft in Fig. 1, and is more plainly shown in Figs. 3 and 8. The extreme end of said slot is brought up on an incline to the surface of the locking-shaft, so that the lower end of the guide-pin *c*, just as the lock-pin is entering the recess in the end of the cone, rises out of the slot *b'''* on this incline and rests on the plain surface of the shaft during the revolutions of the shaft while locked with the cone. At whatever position the locking-pin *b* may be in when disengaged from the cone on the completion of a spring, it is brought into proper position for again entering the recess *a'* in the end of the cone by means of the guide-guard *b''* on and near the outer end of the locking-shaft B. It will be observed, Figs. 1, 3, and 8, that this guide *b''* is a triangular plate of iron, wrapped onto the under side of shaft B when in position, so that the outer point, where the two planes of the triangle meet, rests on the shaft directly under where the outer end of the guide-slot *b'''* terminates, and the inner ends of the planes terminate respectively at the sides of the slot *b'''*, near its inner end, so that when the shaft B is thrown back out from the cone, if it is not in proper position for the pin *c* to enter the slot *b'''*, said pin, as the shaft moves back, will strike one side or the other of the guide *b''* and turn the shaft, so that when the inner end of the inclined plane or guide *b''* reaches the pin *c* the pin drops into the guide-slot *b'''* and the locking-pin *b* on the end of the shaft is in proper position to enter the recess *a'*.

Third. The cone A is held in position to receive into its recess *a'* the pin *b* of the shaft

B, and for its pin a to enter the recess b' of the shaft B by means of the top arm of the spring-friction-brake lever e (see Figs. 6 and 7) being forced upon the intermittently-revolved cone-shaft M by the pin e'' on the shaft d striking the lower arm of e, the lower arm of the lever e being of such shape as to allow the pin e'' to traverse its under surface, holding the upper arm of the lever in contact with the cone-shaft M and operating as a friction-break thereon, retaining that shaft in position until the lock-pins b and a have entered the recess b' and a', when the pin e'' passes from under the lower arm of the lever, allowing it to drop and throwing its upper end out of contact with the shaft M, leaving said shaft free to revolve after the end of the wire is locked. By a device hereinafter described the power is released from shaft M just at the moment when it is in the proper position for relocking the wire, and it is held in that exact position by the break-lever e, as above described, until the wire is relocked.

Fourth. The locking-shaft B is thrown out of and into contact with the cone A, locking and unlocking the wire, by means of the lever D, Figs. 1 and 6, the upper arm of the lever D being attached to the shaft B. On the lower arm is the double inclined plane plate d^2. The pin d' in the counter-shaft d in its revolution strikes the inclined plane d'' of the lever D, throwing the shaft B back from contact with the cone A, and another pin, d^3, Fig. 3, on said counter-shaft, striking the other inclined plane of lever D, throws the shaft B into contact with the cone A, locking the wire.

Fifth. The feeding of the wire with an increasing twist onto the forming-cone A. In the drawings, Figs. 1, 3, 4, and 5, F is the feed-carriage, having the tension feed-arm f, pivoted at f^2 to said feed-carriage, through which the wire passes from the coil on the drum f to the forming-cone A. This carriage F is hung on two cross-rods, F^2, of a rocking frame, F^3, a lower section of which rocking frame is shown in Fig. 9. Along these cross-rods the carriage F slides forward to the right as the wire is fed onto the forming-cone A, its tension-feed arm following the inclined edge of the plate F^4 until a spring is formed, and back to the left to commence another. This carriage has a worm-pin, f'', Fig. 4, passing through between the slotted end of the lever f''' and entering the worm-slot in the worm-shaft g. As the worm-shaft revolves the pin f'' is forced to travel the worm-slot, carrying the carriage f along the rods on which it is hung, the wire feeding onto the forming-cone with the same angle or twist as is the slot of the worm-shaft.

Sixth. The rocking frame F^3 of the feed-carriage F, a section of which is shown in Fig. 9, is pivoted at f^3 and overhung at its lower corners, so that its weight will incline it forward toward the worm-shaft, causing the worm-pin f'', Figs. 3 and 9, to rest in the slot of the worm-shaft while the spring is being formed. When the spring has been formed, the cam g^4, which is located on the counter-shaft d, strikes the regulating pin-screw g'''' of the rocking-arm g''' of the frame F^3, throwing the frame, with the feed-carriage, back from the machine and releasing the worm-pin f'' from the worm-slot g, leaving the feed-carriage free to be returned to its point of starting. When the carriage F has been returned to its point of starting, the cam g'' passes out from under arm g''', and the carriage is then thrown forward by its own weight and again brings the worm-pin f'' into the worm-slot and carries the end of the wire held in the tension-feed arm f forward onto the locking-pin a, where it is locked ready for the formation of a new spring.

Seventh. The drawing from the reel of a sufficient length of wire to commence the formation of a new spring. Before the spring formed has been severed from the wire the rocking back of the frame F^3, as above described, carries with it the tension-feeding arm f, which slips along back on the then stationary wire and engages the same with its tension-hold at a point on the wire as far from its first point of rest as the length of the sweep of the carriage in its backward movement. Upon the spring being then severed from the wire, the frame, rocking forward, carries the additional length of wire gained in the backward movement forward into the locking device.

Eighth. The cutting of the wire when the spring has been formed, so as to separate the formed spring from the remaining wire. In Fig. 1, h is the shears for cutting the formed spring from the remaining wire. h' is a bar connecting the arm h of the shears with h'', the arm of a rocking trip-shaft. The other arm of said trip-shaft is shown as h''', Fig. 7. The pin i in the arm of the crank-shaft K in its revolution trips the arm h''', closes the shears, and severs the wire.

Ninth. Holding the spring in shape on being cut. In forming the spring considerable tension is necessary, and the strong recoil resulting from cutting off the spring from the remaining wire under this tension tends to throw the spring out of shape at the end where severed. To prevent this injury I have devised a shield. In Fig. 3, j is the shield, constructed of a plate concaved so as to cover a little more than the rear half of the cone with the spring formed thereon, and slightly larger in its concave than the surface of the cone. To this shield is attached an arm, j^2, which in its turn is attached to an upright shaft, j'. At the lower end of this shaft j' is attached the curved plate j'''. The spring being formed, the shield is brought against its rear side, before the wire is cut, by means of the cord, pulley, and weight t, and encircles a little more than one-half of the cone with the formed spring thereon, and receives the recoil of the spring when the wire is cut, and retains the same in its proper shape.

Tenth. The disengagement of the spring

when severed from the machine. When the completed spring is severed from the remaining wire by the recoil the spring is slightly expanded against and into the hollow of the shield j, which, being slightly more than the half of a cylinder and of a slightly-increased diameter to the cone, holds the spring free from but still surrounding the cone. At this point of time the locking-shaft B has removed back far enough so that it will not interfere with the removal of the spring over the end of the cone. Pin i''', Fig. 8, on counter-shaft d then strikes the curved arm-plate j''', turning the shaft j', which swings the shield, holding the spring out on the segment of a circle, thus withdrawing the spring from its position surrounding the cone, and as the shield, carrying the spring, is swung away from the cone the end of the spring is brought in contact with the stop P′. The shield continuing to swing back, the spring is forced by the stop P′ out of the shield, and drops free from the machine.

Eleventh. The stoppage of motion from the cone-shaft M after the spring has been formed, letting it stand at rest while other parts of the machine are in motion, cutting the wire, rocking back, and returning feed - carriage, disengaging the spring, &c., and then returning the motion to the cone-shaft to commence the formation of the next spring. This stoppage takes place while the pawl k' on the end of the connecting-rod k goes forward to engage with a new tooth upon the wheel L. In Fig. 7, d is the crank-shaft, and K the crank thereon, through which an intermitting motion is communicated to the cone-shaft M by means of the connecting-rod k, the pawl k' having the loose or rolling pin k'', and the ratchet - wheel L, attached to the cone-shaft M. When the pawl k' reaches the highest point of its travel the pin k'' rolls from its recess down the slot in the pawl and in front of a tooth in the wheel L, in contact with which tooth the pin k'' is held by the pawl k' until it has reached its lowest point of travel, imparting on its descent motion to the cone-shaft M. When the pawl commences its upward travel again the pin k'' is released and rolls down the slot into its recess, where it remains, leaving the cone-shaft at rest until near the highest point of travel of the pawl is reached, when the position of the recess and slot is such that the pin k'' again rolls forward and down into contact with another tooth of wheel L. The pin k'' is almost noiseless in its movements, and from its round surface causes less injury to the teeth of the ratchet-wheel, and by continual change of point of contact with the tooth is itself more durable than the common ratchet-dog.

Twelfth. The double - cone attachment for forming a continuous spring in shape of a double cone, the bases of the double cone being the outer ends of the spring. In Fig. 10, M is the cone-shaft by means of which the cones are revolved in forming the spring, and carries one of the cones. The cones are locked together, while revolving, by means of two pins and recesses, the same as shown in Fig. 6. When so locked the motion of shaft M is communicated to shaft B. N is a pin in the cone of shaft B, under and beyond which the end of the wire is placed when commencing to form a spring. When the shaft commences its revolution the hook of the pin N comes in contact with the wire near its end, holding it firmly enough to the cone to overcome the tension of the feeding-arm F, and as the shafts revolve the wire is wound along over the forming - cones. D is the lever for throwing the shaft B backward and forward, locking and unlocking the cones by means of its connection to the collar P on shaft B.

All the other devices for forming the double-cone spring are identical with those hereinbefore described for forming the single - cone spring, but the pivot for the lever D is then located at a shorter distance from its cam to produce a longer throw of the upper end of the lever.

Power is transmitted to the machine through pulley 1 to power-shaft 2, and thence, through pinion 3 and gear 4, to counter-shaft d, and from the crank K on counter-shaft d, by means of ratchet-lever k and pawl k', to ratchet-wheel L on shaft 5, and from thence, through gear-wheel 6 on said shaft and pinion 7 on speeding-shaft 8, to gear 9 upon said shaft, and this gear 9 meshes with the pinion 10 upon the cone-shaft M. Power is transmitted from the shaft M, by means of pinion 12 thereon, to worm-shaft 13 by means of pinion 14 upon the latter shaft meshing with the pinion 12.

Having fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination, in a machine for forming spiral-wire springs, of a forming-cone, A, having a recess and pin, with a locking-shaft, B, having a corresponding pin and recess, substantially as above described, for the purposes and operating substantially as above set forth.

2. In a wire-coiling machine, the combination of the cone A, adapted for interlocking with shaft B, with the shaft B, having a guide-guard, b'', a guide-slot, b''', and with a guide-pin, c, for the purpose of guiding and holding the locking - shaft in proper position to lock with cone A, all substantially as above described.

3. The friction-brake lever e, in combination with the cone-shaft M, carrying cone A, and the cam - pin e'', substantially as above described, and for the purposes above set forth.

4. The locking-shaft B and the lever D, having double inclined plane d'', in combination with the pins d' on the counter-shaft d to act on the sides of the double inclined plane d'' to throw the locking-shaft B forward into contact with the cone A and back out of contact, substantially as above set forth.

5. The combination of the shaft d, carrying pins i'' i''', the slotted lever f''', having the

double incline i', and the feed-carriage F, having a worm-pin, f'', with the worm g, for the purposes and substantially as above described.

6. In a wire-coiling machine, the rocking frame having the feed-carriage F, with a tension-feeding arm, f, and a rock-arm, g''', in combination with cam g'' on counter-shaft d, substantially as above described.

7. In a wire-coiling machine, the feed-carriage F, having lever f''', with inclined plane i', in combination with pin i'' in counter-shaft d for the purpose of returning the feed-carriage, substantially as above described.

8. In a wire-coiling machine, the shears h, having connecting-rod h', and rocking shaft having trip-arms h'' and h''', in combination with pin i on crank K, substantially as above set forth.

9. In a wire-coiling machine, the shield j and arm j'', having the upright shaft j', with curved plate-arm j''', in combination with pin j'''', substantially as above set forth.

10. In a wire-coiling machine, the shield j and arm j'', upright shaft j', and curved plate-arm j''', in combination with the stop P′, substantially as above set forth.

11. In a wire-coiling machine, the cone A upon shaft M, connected by gears with shaft 8, and shaft 5, having a ratchet-wheel, L, with a pawl, k', with the slot and recess and rolling pin k'', having a connecting-rod, k, in combination with the crank K on revolving shaft d, substantially as above described.

12. In a machine for forming double-cone spiral springs, the cone-shaft M, bearing one half of the forming-cone, provided with a pin, a, and recess a', in combination, substantially as above described, with the locking-shaft B, provided with a pin, b, and recess b', and bearing the other half of the forming-cone.

HIRAM S. HALL.

Witnesses:

PORTER SHELDON,

JAMES I. FOWLER.