

(No Model.)

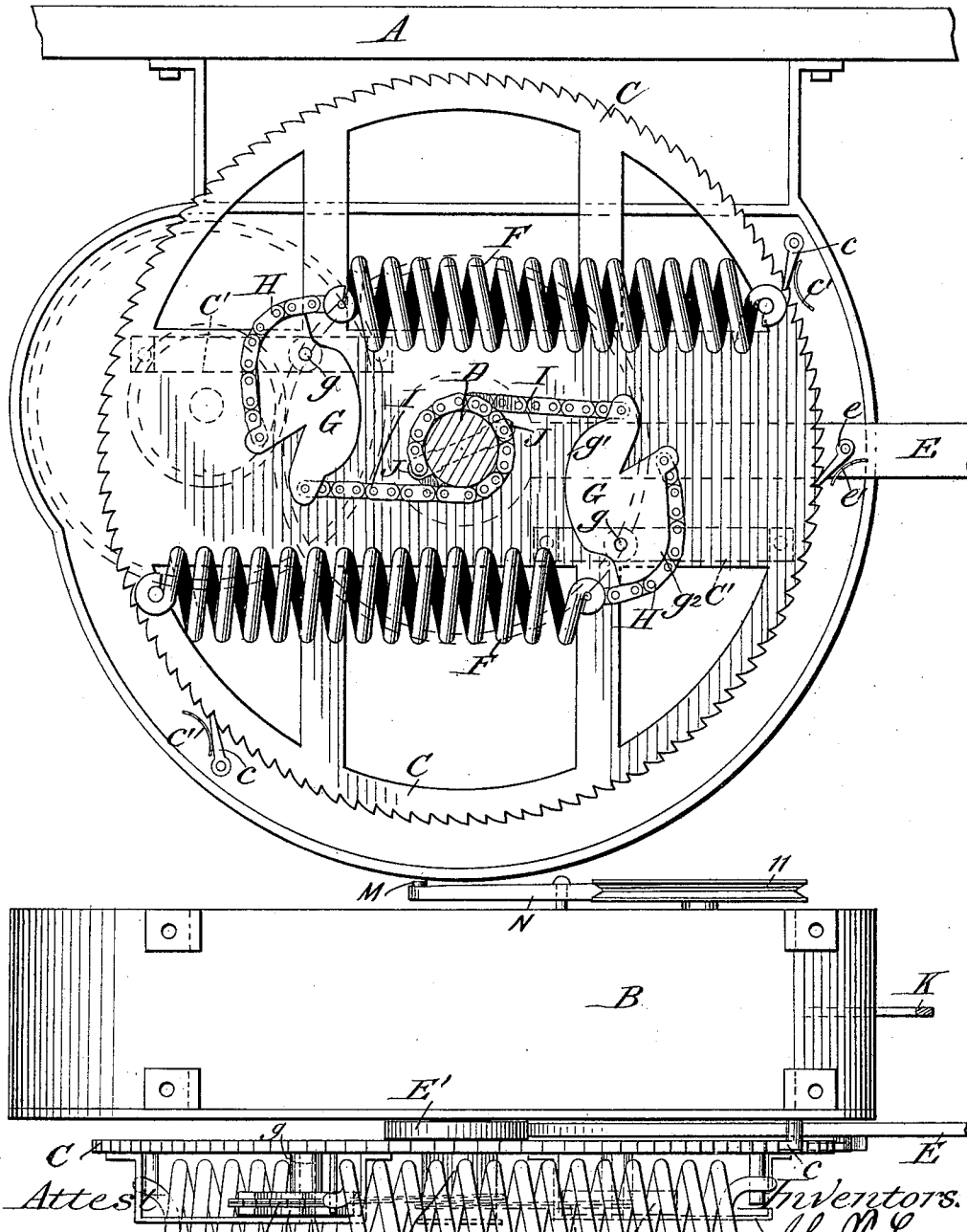
3 Sheets—Sheet 1.

J. F. LANG & J. W. ROPER.  
SPRING MOTOR.

No. 481,714.

Patented Aug. 30, 1892.

*Fig. 1.*



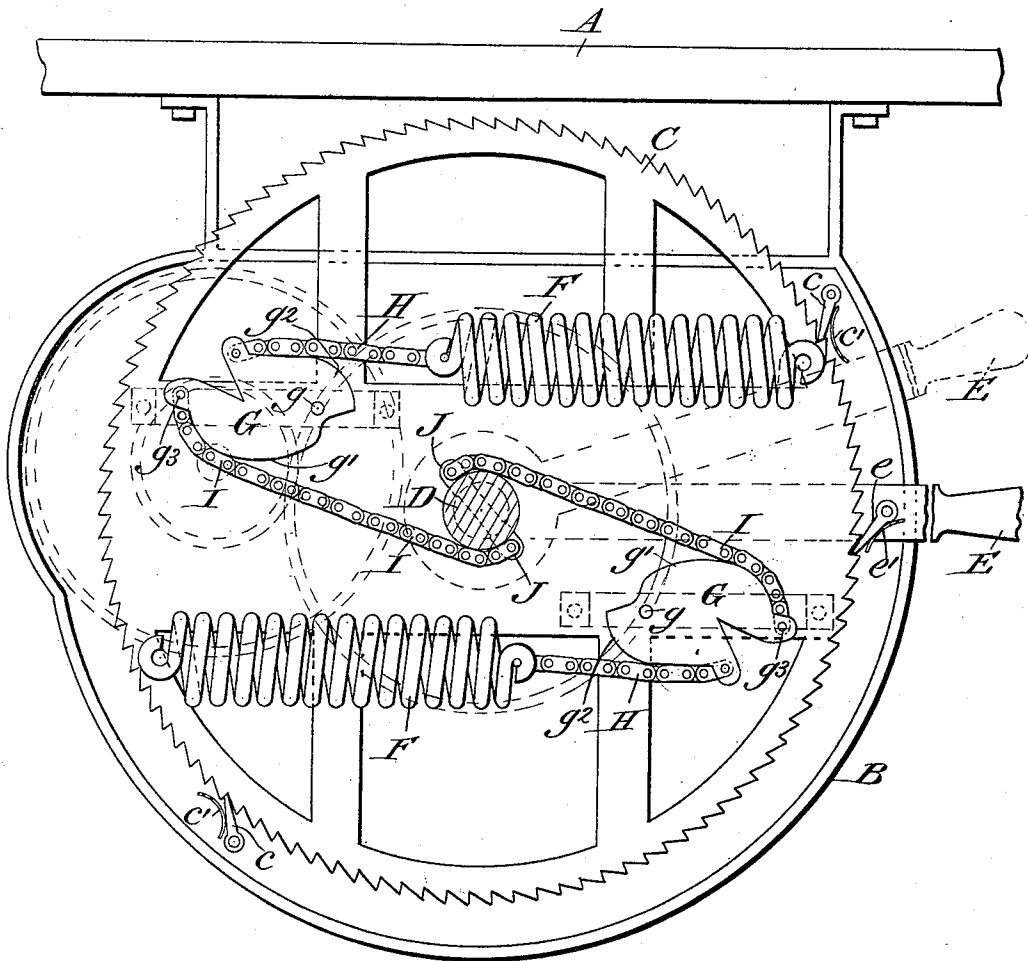
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Att'y.

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*Fig. 3.*



*Attest:*

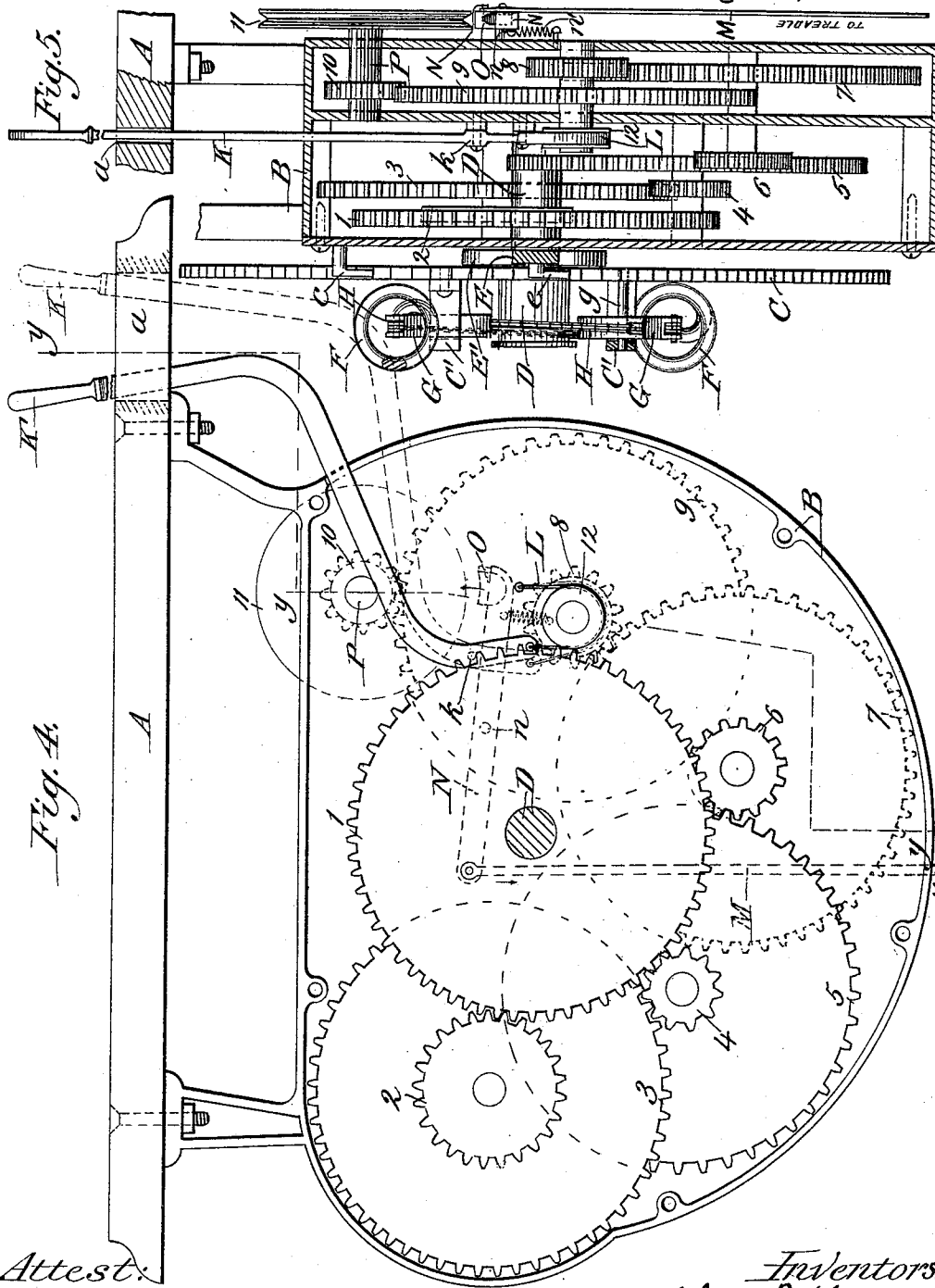
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*per Fred E. Wacker, Atty.*

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per Fred W. Parker, Atty.

# UNITED STATES PATENT OFFICE.

JOHN F. LANG, OF EMERSON, AND JAMES W. ROPER, OF CARTERSVILLE,  
GEORGIA, ASSIGNORS TO THEMSELVES, AND WOODVILLE LATHAM  
AND ENOCH J. RECTOR, OF CHATTANOOGA, TENNESSEE.

## SPRING-MOTOR.

SPECIFICATION forming part of Letters Patent No. 481,714, dated August 30, 1892.

Application filed December 14, 1891. Serial No. 415,009. (No model.)

*To all whom it may concern.*

Be it known that we, JOHN F. LANG, residing at Emerson and JAMES W. ROPER, residing at Cartersville, in the county of Bartow, State of Georgia, citizens of the United States, have invented certain new and useful Improvements in Spring-Motors; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improvement in spring-motors adapted especially for the purpose of driving sewing-machines, but also useful for actuating various other kinds of light machinery.

The object of the invention is to provide a simple, cheap, light, and efficient spring-motor consisting of as few parts as possible, which may be easily wound up at any desired time with the expenditure of a very trifling amount of power, which can be speedily applied to any kind of sewing or other machine, may be quickly stopped or started, and will conform in as full a measure as possible to the multitude of requirements exacted of a motor device of this sort; and the invention therefore consists in the construction, arrangement, and combination of the several parts, substantially as will be hereinafter described and claimed.

In the accompanying drawings, illustrating our invention, Figure 1 is a side elevation of our improved spring-motor, certain of the covering-parts of the frame or casing being removed so as to more clearly expose to view the construction and arrangement of the actuating-springs and their accompaniments the machine being shown as wound up. Fig. 2 is a top plan view of the same without the machine-table. Fig. 3 is a side elevation similar to Fig. 1, but showing the parts in the position that they assume when the machine is not wound up. Fig. 4 is a side elevation of our improved spring-motor viewed from the side opposite to that shown in Figs. 1 and 3, and showing the multiplying gearing. Fig. 5 is a transverse vertical section on the line *y y* of Fig. 4.

Similar letters and figures of reference des-

ignate corresponding parts throughout all the different figures of the drawings.

A designates the horizontal table of a sewing-machine or any other kind of machine with which it is desired to use our motor. Obviously, therefore, this table A may be any kind of a table, patterned in any form and belonging to any kind of a machine. Our purpose is to locate the motor directly beneath said table, securing it thereto so that it may be out of the way and may occupy as small a space as possible, its parts being compacted together into a small space.

B denotes the main casing or framework of our spring-motor machinery. The form, size, and details of construction of this frame may vary within wide limits; and we do not consider that we are to be restricted to any precise or particular pattern or construction thereof, but reserve the liberty of varying it as we please, it being only necessary that it should be so contrived as to permit the necessary mechanical parts of the motor to be conveniently arranged therein and therewith so that their mechanical functions may be carried into effect with the greatest facility for the achieving of the best results. The frame B may in general be termed a kind of a "boxing" or "casing" of small convenient form, secured by bolts, screws, or other suitable means to the underside of the horizontal table A and having arranged therein the parts of the mechanism of the motor, the several shafts or journals of which have convenient bearings in the said frame. This general statement regarding the frame may be sufficient without the need of entering on any detailed description of the exact and precise form thereof.

The form of the frame which is shown in the drawings is merely an example presented here by way of illustration.

The main driving-shaft D is located centrally in the frame B and is supported in bearings, so that it can run easily and with the required speed.

We will first describe the multiplying gearing by which power is transmitted from the shaft D to the drive-pulley and thence to the sewing-machine or other machine which is to

be driven; and afterward we will describe the more important parts of the machine, comprising the coiled drive-springs, the pivoted cams, the chains attached thereto, &c.

5 On the drive-shaft D and rigidly fastened thereto is a gear-wheel 1. This gear engages a pinion 2. On the same shaft with pinion 2 is a gear-wheel 3. Gear 3 engages a pinion 4. On the same shaft with pinion 4 is a gear-wheel 5. All these gears are shown in Fig. 4. The gear-wheel 5 meshes with a pinion 6, which is secured on the same shaft of a large gear-wheel 7 which in turn engages a pinion 8, fixed upon the same shaft that carries a large gear-wheel 9. The gear 9 engages with a pinion 10 on a horizontal shaft P, which carries at its other end a belt-pulley 11, which may be of any suitable form, it being preferably a grooved pulley, and it is adapted to have a belt pass around it, thence upward to the machinery of the sewing-machine located upon the table A, so that the rotation of the pulley 11 may, by communicating power through the belt, drive the machinery above. On the same shaft which carries the pinion 8 and the gear-wheel 9 is a small wheel or pulley 12, which is used in connection with other parts of a brake or speed-regulating mechanism, in the manner that we shall hereinafter presently describe. Thus it will be seen that we have furnished a series of gears whereby motion may be communicated from the shaft D to the pulley 11 and a very slow rotation of the shaft D will, through the action of this multiplying gearing, cause a very rapid movement of the pulley 11 and consequently of the parts of the driven machine.

C denotes a wheel which we term the "ratchet-wheel," it being provided around its entire periphery with suitable teeth, notches, or indentations, which can be engaged by pawls. This wheel is mounted loosely on the drive-shaft D, as shown very clearly in Figs. 1, 2, and 3. This ratchet-wheel may be of greater or less size. It is preferably made considerably larger than the gear 1. In fact, it is found in practice convenient to have it substantially as large in diameter as the frame B when the latter is made in the round form shown in the drawings. However, the wheel C can vary in shape and size as much as may be desired. It may be skeleton or solid. It rotates continuously forward in one direction when actuated by the winding-handle. It therefore constitutes a part of the winding mechanism. We find it convenient to secure a plate C', as shown in Fig. 2, to one side thereof, so as to form a kind of boxing, several of the mechanical parts being located between this plate C' and the wheel C.

c c denote pawls which are pivoted upon the main frame and which engage the teeth of the wheel C at points diametrically-opposite to each other, said pawls being held in engagement with the teeth by means of the small flat springs c' c', which act against the pawls. These pawls keep the wheel C from

any reverse movement and hold it at any point to which it may have been fed forward.

E designates a winding-handle. Its inner end E' is loosely mounted upon the shaft D alongside of the ratchet-wheel C. This winding-lever is moved up and down under the manipulation of the operator whenever any winding of the machine is required. It can very easily be vibrated back and forth with the expenditure of but a trifling amount of energy. This lever is provided with a pawl e, which engages the teeth of the ratchet while being held in engagement with said teeth by means of the spring c'.

Referring to Figs. 1 and 3, it will be evident that when the lever E is lifted the pawl e will slip idly over the teeth of the ratchet-wheel, and then when the lever E is depressed said wheel will be rotated to the extent of the movement of the said lever and the pawls c c will hold the ratchet-wheel and prevent it from having any return movement.

F F denote two pairs of coiled springs, and G G denote a pair of pivoted mathematically-constructed lever-acting cams. The springs F F are made of any suitable wire, so as to have the desired amount of strength or tension. They lie parallel to each other on opposite sides of the main shaft D. They are susceptible of extension and contraction on the lines of their axis. One end of each spring F is pivoted to the ratchet-wheel C at a point close to the periphery thereof. To the other end of each of these springs F is pivotally connected a chain H, composed of suitable inter-pivoted links, said chains H H having suitable lengths and having their other ends pivoted to the cams G G, respectively. The cams G G are pivoted to the wheel C at suitable points on opposite sides of the axis of the wheel—that is to say, on opposite sides of the main shaft D—said cams being diametrically-opposite to each other and being preferably located at points, say, about midway between the center of the wheel C and its circumference. These cams are pivoted on the pins g g, which are fixed in the wheel C, and said cams are located between the face of the wheel and the strip or plate C' when such is used. At least, this is the preferable mode of arranging the cams. We do not intend, however, to be restricted to any particular and specific location or arrangement. The idea is to have the cams pivoted to the wheel at proper points on opposite sides of the wheel's axis. These cams are constructed on mathematical principles and yet their exact form and precise contour admits of a wide variation in actual practice. They have a general elliptical or parabolical form, the pivotal point being near one end of the major axes or at one of the foci, so that the cam may have two properly-curved sides g' and g<sup>2</sup>.

I I indicate chains consisting of suitable inter-pivoted links, said chains being similar to the chains H, and they are pivoted at one end to the cams G and at the other end to

suitable projections or pins J on the shaft D, said chains being adapted to wind once or twice around the shaft D during the operation of winding up the machine and then to unwind as the machine proceeds in its operations. The chains I I are pivoted to the cams G G at points  $g^3$ . The chains H are pivoted to the cams G G at points not far distant from the points  $g^3$ , but the exact points of connection of chains I and H with the cams may vary somewhat, it being only essential that said pivotal connecting-points should be substantially at the opposite end, or thereabout, of the major axis of the general elliptical figure of the cam from where the cam-pivots  $g$  are located, in order that the cam may act as a lever, swinging upon its pivotal point  $g$  as a fulcrum, and as the cam G swings in one direction upon its pivotal point the chain I will come into contact more and more with the curved face  $g'$  of the cam, while the chain H will simultaneously be free from contact more and more with the opposite curved face  $g^2$  of the cam, and when the cam vibrates in the other direction the chain H will lie closely in contact with the curved face  $g^2$  of the cam, as is clearly represented in Fig. 1, while at the same time the chain I will be freed more and more from contact with the other face  $g'$  of said cam, as is also shown in Fig. 1. In Fig. 3 the positions that the cams, chains, and springs assume when the device is unwound are clearly represented, and in Fig. 1 the positions that the same parts occupy after the device has been wound up are shown. When the winding mechanism is operating and the ratchet-wheel is being fed forward, the shaft D is in a stationary position (supposing it to be so merely for the purpose of illustration, although, of course, the winding can take place when the machine is in operation as well as when it is idle) in consequence of the action of the brake upon the drive-pulley or some other driven part. Then the chains I I will wind upon the shaft D once or twice, and the effect of thus shortening the chains I I will be to pull the cams around upon their pivotal points, thereby drawing upon the chains H H and extending the springs F. And in actual practice it will be found that by a few vibrations of the winding-lever the springs F may be extended as far as is desirable—that is to say, they may be stretched until they reach the cams—and occupy the position shown in Fig. 1, where it will be noted that the chains H H lie around the curved edges  $g^2$  of the cams, the end of the spring being contiguous to the cam at a point not far from the cam-pivot, and simultaneously the chains I have been wrapped around the shaft D sufficiently to shorten them as much as may be possible, so that the distance from the shaft D to the end of each cam G at the point where the said chains I are pivoted thereto is quite short, and therefore the cams G have a direct and effective leverage action, functioning as arms, as it

were, pivoted at the points  $g$  and so connected to the chains I that as they vibrate backward on those pivots a strong steady action will be given to the chains I to impart a rotative motion to the shaft D. After the machine has been thus wound up as much as is desirable or possible it can be kept in this position until a release of the shaft D, by removal of the brake or of such other force as there may be acting to hold the shaft D from rotating, has taken place, and then the automatic operation of the machine will proceed, resulting from the resilient tendency of the springs to recoil themselves closely together by contraction on the lines of their axes, and this will shift the cams upon their pivots through the drawing action of the chains H, which, as we have seen, pass around the curved edges  $g^2$  to the pivotal points, which are at some distance from the cam-pivots, and cause the chains I to impart motion to the shaft D, and this in consequence drives the connecting-gearing; actuates the drive-pulley, imparts motion to the sewing or other machine, and performs the work which the motor and machine may be required to do.

Although we have here supposed that the other mechanism is at rest while the winding mechanism is in operation, yet it will be of course understood that the winding of the machine can take place at any time during its operation as well as while it is at rest. The sewing or other machine can run steadily for any length of time, and at intervals when the operator sees that more power is required he can give the lever E a few vibrations, which will afford the additional required amount of power and will carry the operation along until the next winding, and thus the operation of the machine can be made continuous for any length of time, the winding taking place with equal facility as when it is not running.

An extremely important result follows from the construction and arrangement of the cams, springs, and connecting-chains or equivalent means which we have just described. By this combination the action of the springs is equalized at all times, and therefore the running of the machine is constant, steady, and uniform, and not subject to those fluctuations so common in motors of various kinds. The peculiar formation of the cams which permits the chains to wind and unwind as they do is mainly to be credited with this important and valuable result. The cams provide a sort of compensating or equalizing leverage. The leverage diminishes as the springs become more and more extended or stretched. When the springs are in operation driving the mechanism of the motor, it will be evident that their resilient strength diminishes in proportion as they reach the point of complete or ultimate compression, and therefore in order to compensate for this and afford a constant even pull at all times upon the shaft D it is necessary that the cams should, as the compression proceeds, afford a

a constantly-increasing leverage, and when the springs have become nearly compressed it will draw upon the cam at a point the farthest or nearly the farthest distant from the cam-pivot, thus affording a long leverage at that point and therefore a greater power. In other words, by glancing at Fig. 1 we will see that when the springs are extended to their utmost limit the leverage action upon the cam is very small, inasmuch as the spring connects with the cam at a point near its pivot; but when we glance at Fig. 3 and see the spring compressed nearly to its full limit we shall see that the leverage function of the cam has increased greatly, nearly to its fullest extent, so that as the power of the spring to pull diminishes, owing to the extent of its compression, the leverage action of the cam increases for the purpose of supplementing the diminution of power in the spring, and thereby the action upon the shaft D is kept steady and uniform at all times, and the machine runs easily, accurately, and uniformly. It is in this way that the tension of the two chains II that wind upon the shaft D is kept uniform when the chains are unwinding. Both of said chains exert the same rotating effect upon the shaft, although they pull toward opposite points of the wheel; but owing to the above-explained action of the cam they pull with a steady, uniform, and non-fluctuating action.

M designates a rod which connects at its lower end with a treadle (not shown) and with its upper end to a lever N, which is pivoted on the frame by means of a pivot *n*, and which carries at its other end a shoe O, which is adapted to act as a brake against the belt-pulley 11. A spring *n'* is attached at one end to the lever N at a point near the shoe O, and at its other end is fixed to a pin on the frame, the tendency of this spring being to draw the shoe away from the wheel, keeping the brake normally disengaged. The operator by simply pressing upon the treadle can therefore vibrate the lever N and cause the shoe O to be brought in contact with the wheel, so as to act as a brake whenever desired. This is one form of brake mechanism. Others may be devised and used in lieu thereof, if preferred. We also have provided a form of brake or speed-regulator mechanism which can be used in conjunction with the one just described or can be used independently, whichever may be preferred. This speed-regulating mechanism consists of a curved lever K, pivoted near its lower end by means of a pin *k* to the frame. The handle end K' of the lever K projects through a slot *a* in the table A, and is situated at a convenient point to be readily grasped by the hand of the operator and shifted from the position shown in full lines in Fig. 4 to that shown in dotted lines in the same figure, or vice versa, or placed at any intermediate point between the two positions indicated. The lower end of the lever K, below its pivotal point *k*, has attached thereto one end of a metallic or other strap L, whose

other end is connected to a point on the frame, said strap passing around the smooth pulley 12 on the shaft which carries the pinion 8 and gear 9, to which we have hereinabove referred. When the lever K is in the position shown in full lines in Fig. 4, the strap L will not bind tightly upon the pulley 12. By manipulating the handle K', however, strap L may be caused to bind more and more tightly with a greater or less braking action upon the pulley 12, and consequently the speed may vary or diminish or the machinery may be entirely stopped. Thus the operator has the machine under his control at all times and can regulate the speed as he may prefer.

Various modifications and changes may be made in the precise form, arrangement, and location of the various parts, so as to change more or less the function and united action thereof and adapt the machinery for serving in different locations and have a variety of purposes, without departing from the principal lines of the invention or from the just and true scope of the following claims. Therefore we reserve the liberty of making numerous changes, as experience may dictate.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a spring-motor, the combination of a driving-shaft, a wheel, pivoted devices on said wheel, coiled springs connected to said wheel and to said devices, and connections between said devices and the shaft.

2. In a spring-motor, the combination, with the main shaft, of a winding-wheel and parallel coiled springs pivoted thereto, said springs being capable of extension and contraction in the line of their axes and being so connected and arranged with the shaft as to actuate the latter, substantially as described.

3. In a spring-motor, the combination, with the main shaft, of a winding-wheel mounted thereon, coiled springs pivoted to the wheel near its periphery, pivoted lever-acting cams having suitable elliptical or curved edges, chains connecting the ends of the springs with said cams, and chains connected to the main shaft and also to the said cams, so that when the winding-wheel is rotated forward the chains may wind on the shaft, substantially as described.

4. In a spring-motor, the combination of a main driving-shaft, the winding-wheel, cams pivoted to said wheel, said cams having suitably-curved edges and having their pivotal points near one end thereof, connections between the cams and the main shaft, and coil-springs which are capable of expansion and contraction in the line of their axes, said springs being connected to the wheel and to the cams, substantially as described.

5. In a spring-motor, the combination of a main shaft, a ratchet-wheel, pivoted cams on said wheel on opposite sides of the shaft, coiled springs pivoted to the wheel near its

periphery, chains connecting the other ends of said springs with the cams, and chains connecting the cams with the shaft, substantially as described.

5 6. In a spring-motor, the combination of a driving-shaft, a winding ratchet-wheel, a holding pawl or pawls therefor, a winding pawl-carrying lever, cams pivoted to said wheel, the coiled springs on the wheel near its periphery, and connections between the springs and its cams and between the cams and the shaft, substantially as described.

15 7. In a spring-motor, the combination, with a driving-shaft, of the winding-wheel mounted thereon, a cam pivoted to said wheel, a coiled spring pivoted to the wheel near its periphery, a flexible connection between the other end of said spring and the cam, and another connection between said cam and the shaft, substantially as described.

20 8. In a spring-motor, the combination of a main driving-shaft, a winding-wheel mounted loosely thereon, an elliptical or curved cam pivoted near one of its foci to the wheel, a coiled spring pivotally connected to the wheel near its periphery, a flexible chain or cable connection between the end of the spring and the cam, and another similar connection between the cam and the shaft, which latter is adapted to wind about the shaft, all arranged so that the leverage of the cam will increase as the resiliency of the spring decreases in the compression of the latter, so that thereby an equality of action may be produced in the operation of the driven shaft, substantially as described.

35 9. In a spring-motor, the combination of a main driving-shaft, a ratchet-wheel mounted loosely thereon, cams pivoted to the face of said wheel, coiled springs pivoted to the wheel near its periphery, flexible connections between the ends of said springs and the cams, similar connections between the cams and the main shaft that wind around the latter, holding-pawls for the ratchet-wheel, the winding-handle provided with a pawl that engages the said wheel, the fixed gear on the main shaft, and suitable multiplying gearing between it and the driving-pulley, substantially as described.

50 10. In a spring-motor, the combination of the main driving-shaft having a fixed gear thereon, a train of gearing between it and the driving-pulley, and suitable braking devices for regulating the speed of the driving shaft and gearing, a winding-wheel mounted loosely on the driving-shaft, the actuating coiled springs for said winding-wheel, pivoted there-

to and arranged so as to exert their resiliency to produce a rotation of the main shaft, and a winding-lever which engages the said winding-wheel and rotates it sufficiently to extend the springs and thereby wind up the machine when required, substantially as described.

65 11. In a spring-motor, the combination, with the main shaft, of a winding-wheel thereon, coiled springs pivoted to the wheel, cams pivoted to the wheel, and connections between the springs and cams and the cams and shaft, the gearing actuated by said shaft, a smooth pulley on one of the gear-shafts, a strap partially surrounding said pulley, and a bent vibratory lever pivoted on the frame and connected to one end of said strap, the whole arranged for the purpose of regulating the speed of the machine, substantially as specified.

75 12. In a spring-motor, the combination of the main shaft, a suitable train of gearing to be actuated thereby, a wheel mounted loosely on said shaft, coiled springs pivoted thereto near its periphery, and cams  $G G$ , pivoted to the wheel near the end of their major axes at points  $g g$ , said cams having the oppositely-located curved edges  $g'$  and  $g^2$ , and the flexible connecting-links pivotally attached to the cams at their ends farthest from their pivotal points and to the main driving-shaft and the free ends of the coiled springs, respectively, substantially as described.

90 13. In a spring-motor, the combination, with the main shaft, of winding mechanism consisting of a rotary wheel, a handle for rotating it, a coiled spring for driving it, said spring being pivoted on the face of the wheel and capable of expansion and contraction in the line of its axis, and a connection between said spring and the shaft, so that after the spring has been extended the force of its compression may rotate the said shaft, substantially as specified.

100 14. The combination, in a spring-motor, of the shaft, a wheel mounted thereon, and a coiled spring carried on the face of said wheel, said spring being capable of expansion and contraction in the line of its axis and arranged and connected with the shaft for the purpose of actuating it, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

JOHN F. LANG.

JAMES W. ROPER.

Witnesses:

R. L. JOHNSTON,

SAML. C. WILSON.