(No Model.)

4 Sheets—Sheet 1.

A. A. WOOD.

SPRING MOTOR.

No. 470,611. Patented Mar. 8, 1892.

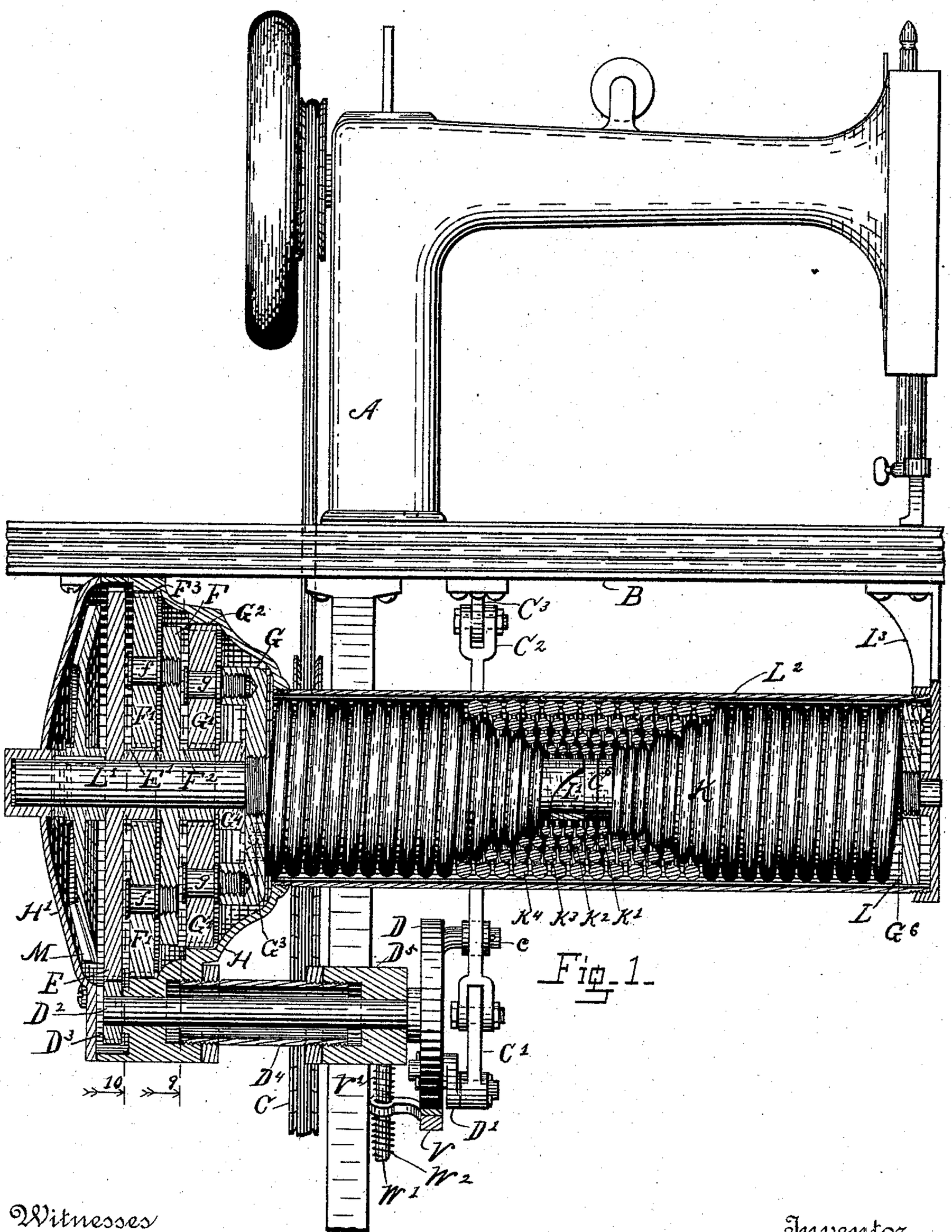

Fig. 1.

Witnesses
L. F. Hayden
A. Z. Green

Inventor
Albert A. Wood.
by Attorneys
A. A. Wood & Son

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SPRING MOTOR.

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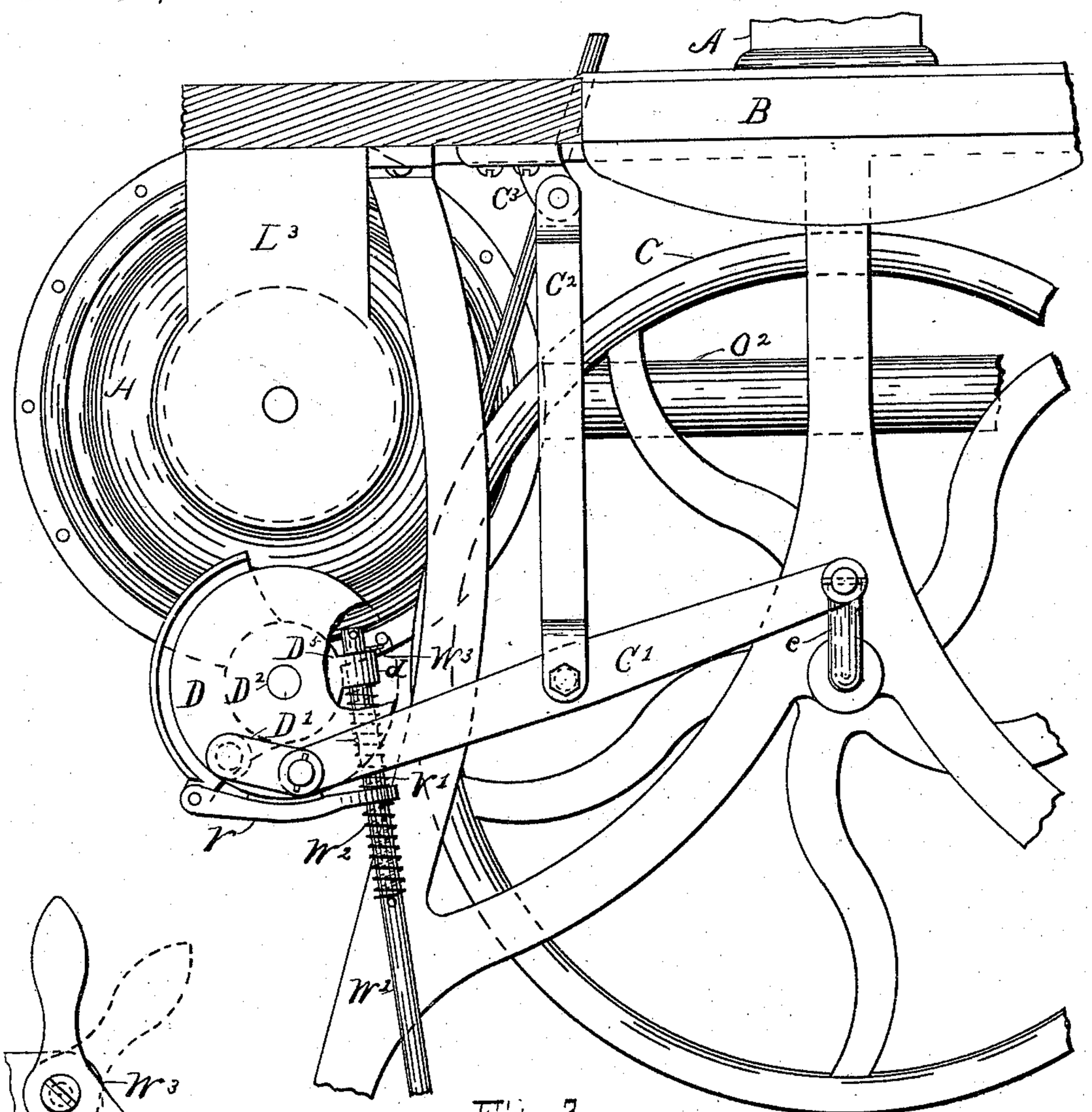

Fig. 2.

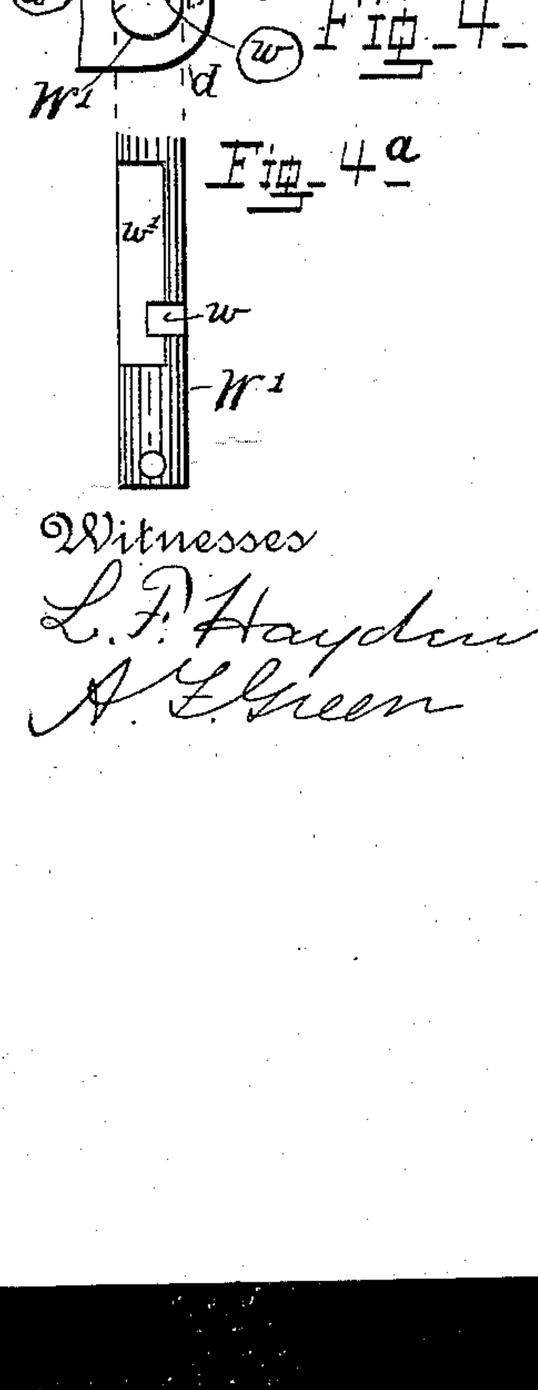

Fig. 4.

Fig. 4a

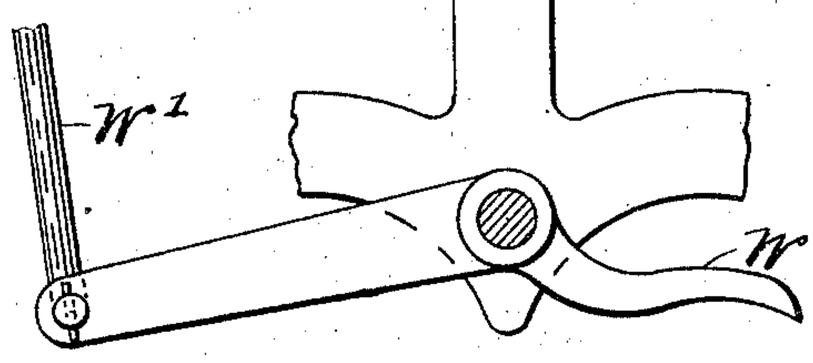

Fig. 3.

Witnesses
L. F. Hayden
A. E. Green

Inventor
Albert A. Wood.

By Attorneys
A. A. Wood & Son

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A. A. WOOD.

SPRING MOTOR.

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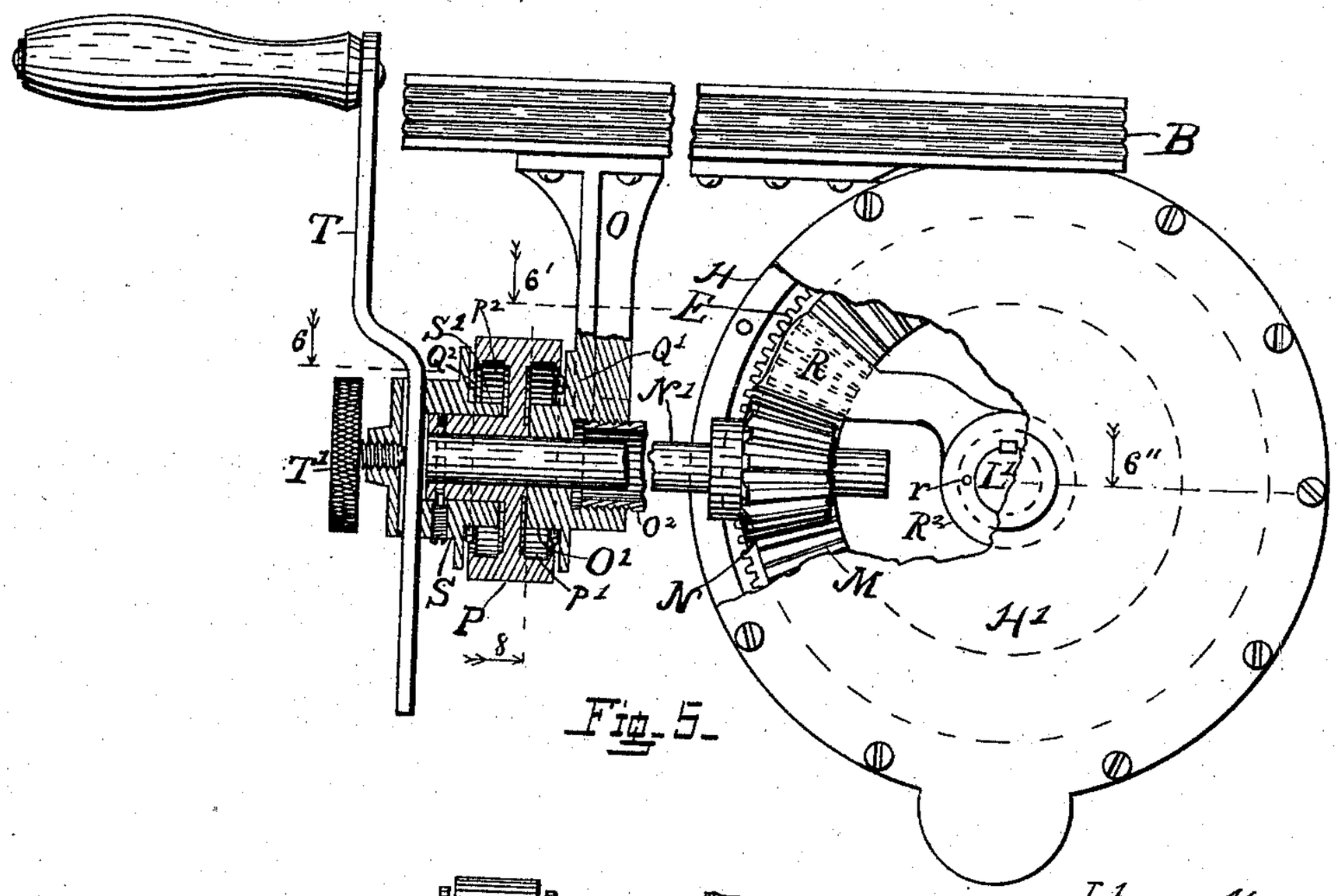

Fig. 5.

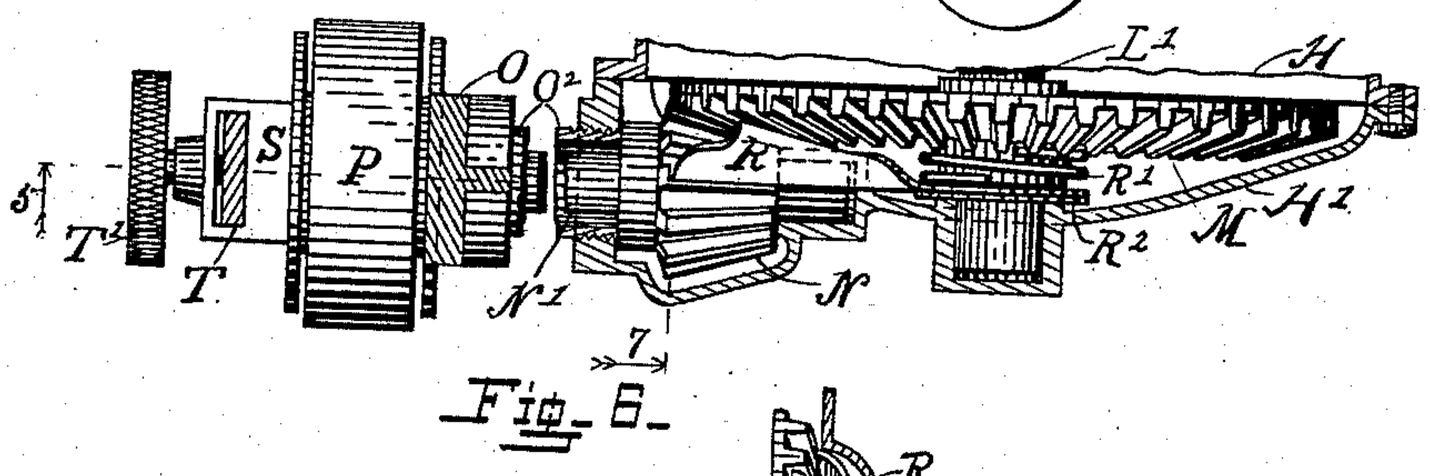

Fig. 6.

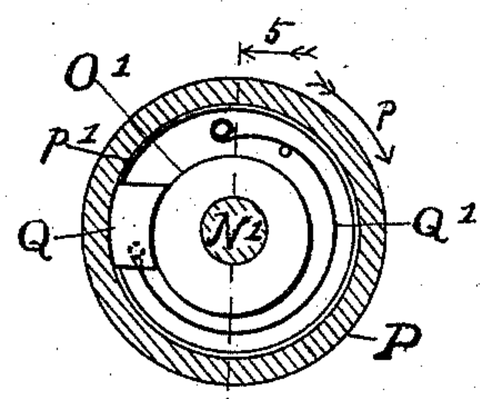

Fig. 8.

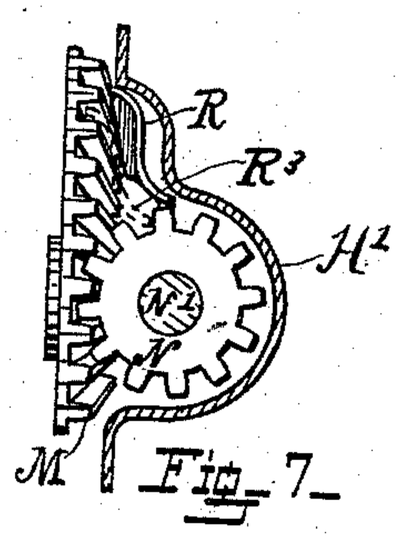

Fig. 7.

Witnesses
L. F. Hayden
A. G. Green

Inventor
Albert A. Wood
by Attorneys
A. A. Wood & Son

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A. A. WOOD.

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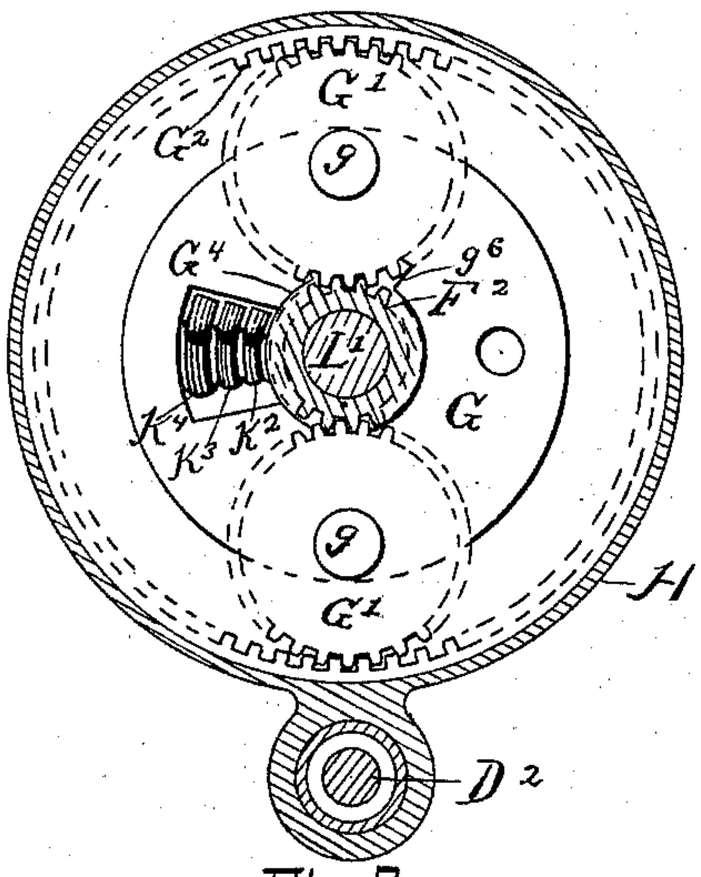

Fig. 9.

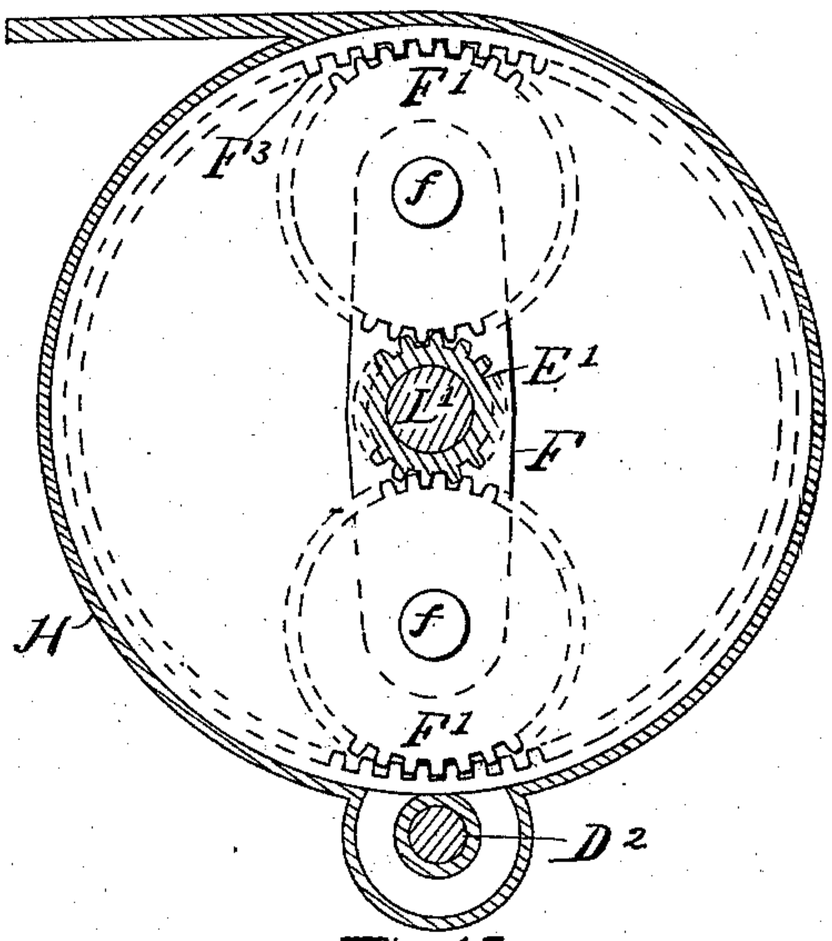

Fig. 10.

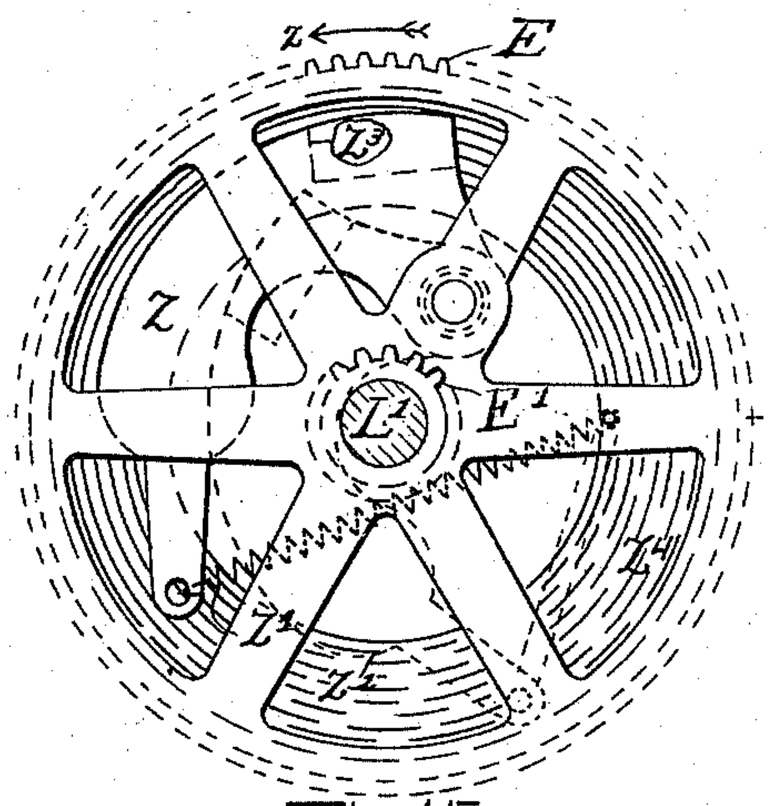

Fig. 14.

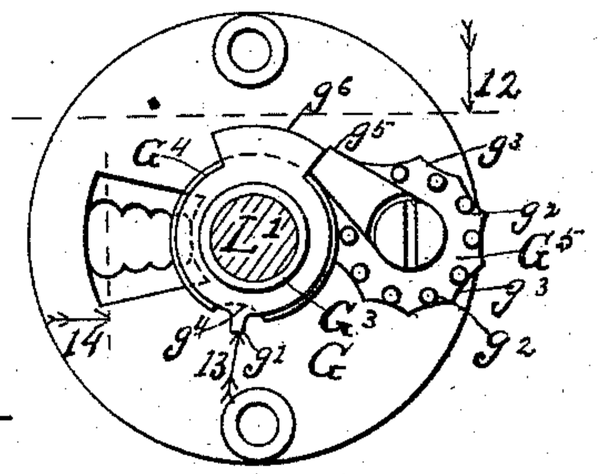

Fig. 11.

Fig. 15.

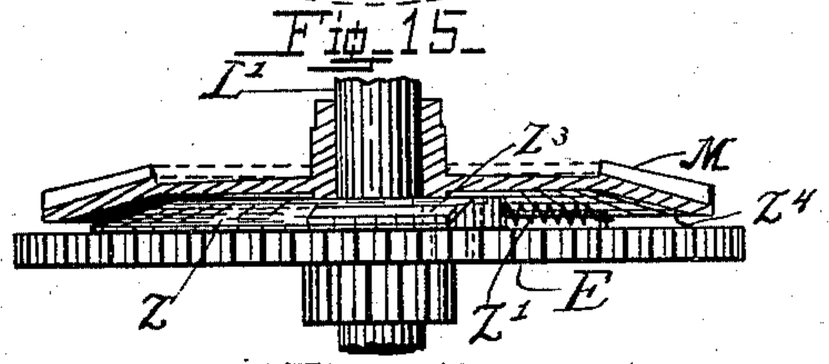

Fig. 16.

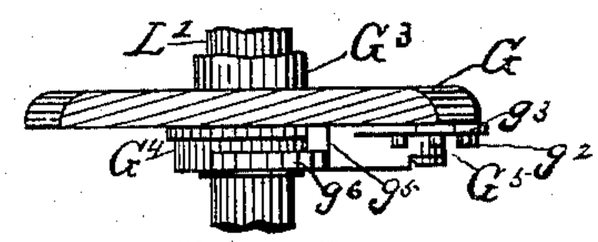

Fig. 12.

Fig. 13.

Witnesses.
L. F. Hayden
A. F. Green

Inventor
Albert A Wood.

By Attorneys
A A Wood & Co

UNITED STATES PATENT OFFICE.

ALBERT A. WOOD, OF ATLANTA, GEORGIA, ASSIGNOR TO W. I. ZACHRY, G. A. HOWELL, J. M. BROSIUS, AND T. S. LEWIS, OF SAME PLACE.

SPRING-MOTOR.

SPECIFICATION forming part of Letters Patent No. 470,611, dated March 8, 1892.

Application filed March 30, 1891. Renewed February 1, 1892. Serial No. 419,964. (No model.)

To all whom it may concern:

Be it known that I, ALBERT A. WOOD, a citizen of the United States of America, and a resident of Atlanta, in the county of Fulton and State of Georgia, have invented a certain new and useful Spring-Motor; and I 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, reference being had to the accompanying drawings, and to letters of reference marked thereon, which said drawings form a part of this specification.

This invention consists of a peculiarly-constructed spring and mechanism for winding it, mechanism for transmitting stored-up power and to regulate, automatically and arbitrarily, the speed resulting therefrom, and of other details, all of which are illustrated in the accompanying drawings and will be fully described in this specification.

The figures showing the invention as being attached to a sewing-machine are briefly described as follows:

Figure 1 is an elevation of the back side of a sewing-machine, showing a part of the table and the motor, a part of the motor being in vertical section central to the axis of the spring. Fig. 2 is a cross-section of the table and a view of the motor, looking from the direction of the right-hand side of Fig. 1, showing the connection of the motor mechanism with that of the sewing-machine. Fig. 3 is a view of the pedal by which the speed of the machine is arbitrarily governed. Figs. 4 and 4ª show an enlarged view of the locking mechanism by which the motion of the motor may be prevented. Fig. 5 is an elevation of the motor, the view being from a direction opposite that shown in Fig. 2, a part of the figure being in section on the lines 5, Figs. 6 and 8, and another part having a portion broken away to show the winding-gearing inside the motor-casing, and a brake to prevent an accidental recoil of the spring. Fig. 6 shows a plan of the winding-gears and the stop to prevent the recoil, the casing being in section on line 6″, Fig. 5, and also of the part shown in vertical section in Fig. 5, the crank and hanger being in section on lines 6 and 6′, respectively, Fig. 5. Fig. 7 is a section through the casing-cover on the line 7, Fig. 6, and shows an end view of the stop to preveut the accidental recoil of the spring and its lateral position to the winding-gears. Fig. 8 is a section on the line 8, Fig. 5. Fig. 9 is a profile of a section on the line 9, Fig. 1, and shows the planet-gears that first transmit the power from the spring. The pinion of the disk that carries the second pair of planet-gears is shown in section. This figure also shows a part of the device for limiting the winding and unwinding of the spring. Fig. 10 is a profile of a section on the line 10, Fig. 1, and shows the second pair of planet-gears, and in section the pinion of the spur-gear that drives the crank-shaft. Fig. 11 is a view of the disk that carries the first pair of planet-gears and the device for limiting the coiling and uncoiling of the spring. Fig. 12 is a sectional view of Fig. 11 on line 12 in that figure. Fig. 13 is a view from the direction and of the part indicated by the arrow 13, Fig. 11. Fig. 14 is a section through a portion of Fig. 11 on the line 14 in that figure, showing the attachment of the spring. Fig. 15 is a side view of the spur-gear that drives the crank-shaft and of the back of the contiguous beveled winding-gear, showing the device by which an excessive speed is automatically prevented. Fig. 16 is an edge view from the top of the spur-gear shown in Fig. 15, and a horizontal section on the line 16 in that figure of the beveled gear, showing a profile of the back of the bevel-gear, with which the governor has frictional contact.

In the figures the different details are uniformly marked by reference-characters.

The sewing-machine head A, table B, and band-wheel C, Figs. 1 and 2, may be of any ordinary construction, as the device to be hereinafter described is shown as having connection with the band-wheel-driving crank; but the usefulness of many of the features of the invention are not limited to this form of construction, nor to the driving of sewing-machines, as many other kinds of machines can be driven by this motor with equally good results, and often it might be preferable to make the connection between the motor and machine by a belt instead of the con-

necting-rod that is shown in Figs. 1 and 2. The connecting-rod C′, (best shown in Fig. 2,) connects the treadle-crank *c* on the band-wheel shaft with the crank-disk D by means of the link D′, said link being journaled in the connecting-rod and in the disk, as shown. The arm C^2 is pivoted on the bracket C^3 and on the connecting-rod C′, and gives the said rod fulcrumal support and causes it to carry the crank *c* over the "dead-centers." The disk D is fastened on one end of the shaft D^2, and on the other end is fastened the pinion D^3, which is best shown in Fig. 1, as is also the train of gearing, that will now be described, except when reference shall be made to other figures. The spur-gear E, that engages with the pinion D^3, and the disks F and G, that carry the studs *f* and *g*, on which run the planet-gears F′ and G′, run loosely on the winding-shaft L′, that will be described hereinafter. The planet-gears G′, running on the studs *g* on the disk G, engage the internal gear G^2, preferably cast integrally with the casing H, and the pinion F^2 on the disk F, as shown in Figs. 1 and 9. The planet-gears F′, running on the studs *f* on the disk F, engage the internal gear F^3 and the pinion E′ on the spur-gear E, as shown in Figs. 1 and 10. Thus it will be seen that the crank-shaft is driven by a system of planet-and-spur gearing from the disk G. The compound torsion-spring K is attached at one end to the disk G and at the other to the disk L, the preferred form of attachment being best shown in Figs. 11 and 14, and consists of the bent ends of the spring passing through a slot and around one of its edges, the slotted portion of the disk and the ends of the spring being shown in sectional Fig. 14, both the disks G and L being alike in this respect. The spring K is composed of a series of coils K′, K^2, K^3, and K^4, the number being governed by the requirements, and the object being to obtain a greater elasticity than could be gotten in a common torsion-spring of a given length and strength, the different coils being made from wire of a gage in proportion to its length, in order that the limit of torsional elasticity of each shall be the same. Of course the limit of elasticity of the entire spring is that of its separate coils, and its strength is the combined strength of all the coils. The disk G is screwed on the sleeve G^3, Figs. 1 and 12, said sleeve being a running fit on the shaft L′. It is preferable that the sleeve G^3 should have only as much length as necessary to furnish a sufficient bearing for the disk G, and that the balance of the length of the shaft between the disks G and L should be covered with similar loosely-running sleeves G^6, that can usually be made from common pipe in short sections. The object of the short sleeve is to furnish a core for the spring that will run, each section having a tendency to accommodate itself to the difference in the speed of revolution at the different longitudinal points of internal bearing of the spring, there being no other friction of practical consequence in the spring. These sleeves fill the space between the two disks, and the collar G^4, fastened on the shaft L′, prevents their spreading. The collar G^4 also has, in connection with the wheel G^5, another function—namely, that of limiting the winding and unwinding of the spring K. The collar G^4 has a projecting finger *g*′, that at each revolution engages one of the pins g^2 on the wheel G^5, on the face of which is a series of circular indentations g^3 of the same radius as the collar G^4 and the same in number as the pins g^2. The collar G^4 has a depression g^4 (shown in Figs. 11 and 13) in its face to allow the points between the indentations g^3 to pass. At a little less than a revolution in either direction the part g^5 on the wheel G^5 will meet the part g^6 on the collar G^4 and stop the winding or unwinding in that direction. The spring K being attached to the disks G and L, its effective force is exerted on the disk G and the spring is wound and the accumulated tension is held by the disk L, as will be explained. The disk L is fastened on the shaft L′, preferably by being screwed on and keyed, as shown in Fig. 1. Near the other end of the shaft L′ is keyed the bevel-gear M, and on the lateral shaft N′, Figs. 5, 6, and 7, is the pinion N, meshing with gear M. The other end of the shaft N′ at the front of the machine-table is journaled in the hanger O, on the front side of which is the cylindrical boss O′, which is eccentric to the shaft, and on the shaft is fastened the drum P, having an interior cylindrical surface *p*′, surrounding the boss O′.

Referring to Fig. 8, the turning of the drum P in the direction indicated by the arrow *p* will wind the spring, and on the stopping of the winding the drum P will be held and reaction will be prevented by the friction of the curved wedge Q, between the eccentric cylindrical surface on the boss O′ and the internal cylindrical surface *p*′. The spring Q′ presses the wedge in the direction of the convergence of the opening between the boss O′ and the surface *p*′.

To provide against the consequences of the accidental slipping of the friction-clutch thus described, a safety-stop R, Figs. 5, 6, and 7, is applied to the winding-gears M N. The stop R consists of an arm pivoted on the hub of the gear M and pressed by the coil-spring R′ against the washer R^2, that is fastened to the hub by the pin *r*, Fig. 5, and revolves with it. While the gear M moves forward or upwardly, as shown in these figures, it will carry with it the stop R by frictional contact with the washer R^2 until the stop is stopped by contact with the casing-cover H′; but when moving downwardly or in the backward direction the said frictional contact will carry the lower edge of the stop R down into the teeth of the pinion N, which by its backward revolution will give the stop a lateral movement, carrying the upper edge into the teeth of the gear M, as shown by the broken lines

R^3, Fig. 7, effectually locking these gears and preventing the further reaction of the spring K. The forward movement of the gears will release the stop and the spring R′ and the frictional contact of the stop R, with the washer R^2 will return it to its normal position.

On the hub of the drum P is journaled a flanged sleeve S, having an eccentric cylindrical boss S′, that is surrounded by the internal cylindrical surface p^2 on the drum P, the said internal cylindrical surface and eccentric cylindrical boss being provided with a contacting curved wedge and a spring Q^2, that are like, and perform the same functions as, the wedge Q and spring Q′, described above. On the side of the flange on this sleeve and at a right angle to its axis is a rectangular hole through which the crank T passes. The crank T slides through this hole to adjust its length, and is held in position as to length by the screw T′. By reason of the friction-clutch connecting the sleeve S with the winding-shaft the crank may be used as a crank or as a lever, winding by a back-and-forth movement.

The speed of the crank-disk D and of the driven machine is regulated by the pressure of the friction-brake lever V, Figs. 1 and 2, against said disk, the pressure being given by the foot-pedal W, Fig. 3, pivoted near the floor and connected with the lever V by the rod W′, passing loosely through a hole in the free end of the lever V and through a hole in the lug *d* on the journal-box D^5. Connection between the rod W′ and the lever V is by a coil-spring W^2 of considerable stiffness, as shown in Figs. 1 and 2, and the brake-lever V is held away from the disk D when not in use by the lighter spring V′, (shown in the same figure,) which abuts against the bottom of the lug *d* and the top of the brake-lever V. After the brake-lever V shall have been pressed against the disk sufficiently hard to stop the machine it may be locked in that condition by compressing the spring W^2 enough to cause the notch *w*, Figs. 4 and 4^a, in the rod W′ to coincide vertically with the lever W^3. The rod W′ is flattened for a short distance above the notch *w*, as shown at *w′* in Figs. 4 and 4^a, and the lever W^3 has a notch formed between the prongs w^2 and w^3, which will allow the rod to drop slightly and catch on the shoulder formed by the flattened portion *w′*, as shown by the broken lines in Fig. 4, which will prevent the turning back of the lever W^3 without first slightly raising the rod W′, which will prevent the accidental unlocking of the friction-lever.

To prevent an excessive speed that might be caused by accidentally removing the resistance to the force of the spring, the arm Z, Figs. 15 and 16, is pivoted to the side of the gear E, and is so proportioned and arranged, as shown in these figures, as to be thrown out by centrifugal force into contact with the beveled back side of the gear M, which is always stationary or running in the direction opposite to the gear E. The weight of the arm Z and the stiffness of the spring Z′ should be such as will cause the spring to hold the arm in the position shown by the broken lines Z^2 at any ordinary or desired speed, but that will allow the centrifugal force at any faster speed to throw the arm to the position shown in Fig. 15, in which position the face Z^3 will come into contact with the beveled surface Z^4 on the back of the gear M, and, by reason of the turning-point of the lever being nearer to the center of revolution than the contacting-point on the surface Z^4, the wheel E, running in the direction indicated by the arrow *z*, will force the face Z^3 against the inclined surface Z^4 with a force in proportion to its resistance to slipping and to the angle of the arm, and thus regulate the speed with the required accuracy. It is obviously non-essential that the part having the surface Z^4 should be a gear.

The preferred form of construction for the frame of the outlying parts of this machine—that is to say, the parts not contained in the casing H H′—is by a pipe or tube L^2, Fig. 1, that connects the hanger L^3, in which the shaft L′ is journaled, with the casing H, the pipe D^4, same figure, that connects the box D^5, in which the crank-shaft D^2 is journaled, with the casing H, and the pipe O^2, Figs. 2, 5, and 6, that connects the hanger O, in which the shaft N′ is journaled, with the casing-cover H′, the pipes being screwed into the respective parts.

The casing and hangers may be attached to the driven machine in any approved way, they being shown as screwed to the wooden table of a sewing-machine.

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

1. In a device of the class specified, the winding-shaft N′, the drum P, fastened on said winding-shaft and having an internal cylindrical surface *p′*, a stationary boss O′, the cylindrical surface of which is correlative and eccentric to said surface *p*, and a wedge Q, fitting said correlative surfaces, for the purpose specified.

2. In a device of the class specified, the gears M and N, journaled so as to intermesh, the stop R, journaled freely on the hub of the gear M, the washer R^2, forming a shoulder on the said hub for the portion of said stop around said shaft, and a spring R′, operating to cause frictional contact of the stop and the said shoulder, substantially as and for the purpose specified.

3. In a device of the class specified, the gears M and N in the train of winding mechanism and the automatically-acting stop R, mounted on a spring-shaft and having frictional contact with the moving parts of the

said mechanism and adapted to engage both said gears, substantially as shown and described, and for the purpose specified.

4. In a device of the class specified, a shaft surrounded by a coiled torsion-spring and a multiplicity of short sleeves forming a core for said spring and running loosely on said shaft for the purpose of preventing the wearing of said spring.

5. In a motor, a torsion-spring consisting of a series of different-sized wires coiled concentrically, the smaller wires being arranged inside the others in graduated order, said wires being secured at their ends to disks, substantially as described.

6. In a device of the class specified, as a means of limiting the winding and unwinding of the driving-spring, the collar G^4, attached to the winding-shaft and revolving with it and having the projecting part g' and g^6 and the depression g^4, in combination with the disk G, that is revolved by the driving-spring and has journaled on its side the wheel G^5, carrying a series of pins g^2 on its side and an equal number of circular indentations g^3 in its periphery, and the projecting part g^5, all constructed and arranged substantially as described.

7. In a device of the class specified, as a means of transmitting rotary motion from one crank to another, the crank-disk D, the link D′, pivoted thereon, the connecting-rod C′, pivoted to the link D′ and to the crank *c* of the machine to be operated, and the pendulum-arm C^2, stationarily pivoted at one end and at the other pivoted to the middle of the connecting-rod C′, substantially as specified.

8. In a device of the class specified, the combination of the rod W′, having the notch *w*, the lever V, lug *d*, and the lever W^3, pivoted on said lug *d* and adapted to be turned into the said notch and prevent movement of said rod, for the purpose specified.

9. In a device of the class specified, the combination of the rod W′, having a notch *w*, and a flattened portion *w′*, a lug *d*, through which said rod may move vertically, a brake-lever V, elastically connected to said rod and operating upon a wheel, and a lever W^3, pivoted on said lug and said lever having prongs w^2 and w^3 thereon, substantially as described.

10. In a device of the class specified, the arm Z, pivotally secured to a wheel or gear E, the part having the internal conical surface Z^4, and means for holding said arm normally and elastically away from the said surface, the said arm being so pivoted relatively to the surface Z^4 as to be thrown out against said surface by the increased centrifugal force due to an excessive speed, substantially as and for the purpose specified.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

ALBERT A. WOOD.

Witnesses:
L. F. HAYDEN,
A. P. WOOD.