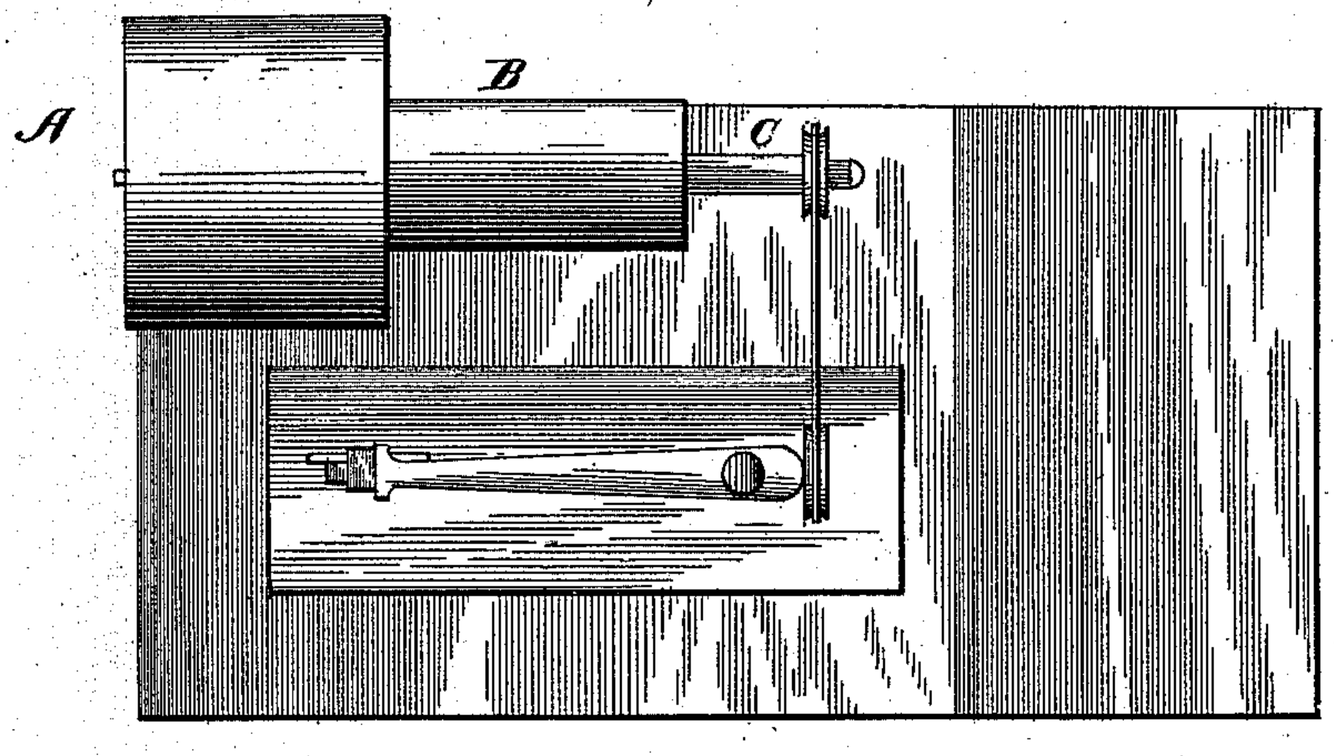
(No Model.) 3 Sheets—Sheet 1.

J. T. MILLER.

SPRING MOTOR.

No. 413,954. Patented Oct. 29, 1889.

Fig 1.



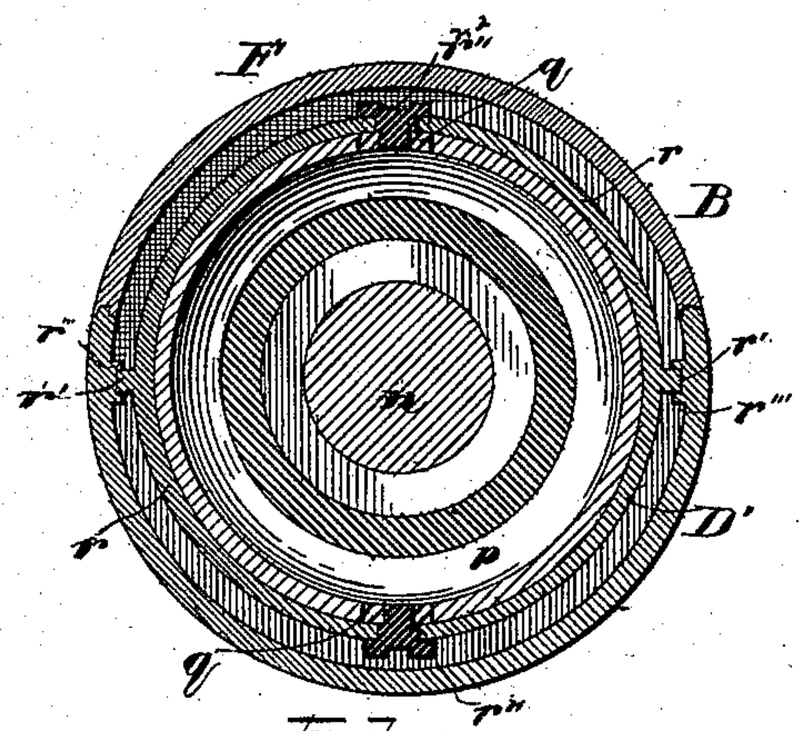


Fig 3.

Witnesses
E. M. Berry.
Frank L. Dyer

Inventor
James T. Miller;
By his Attorney
Geo. H. Dyer

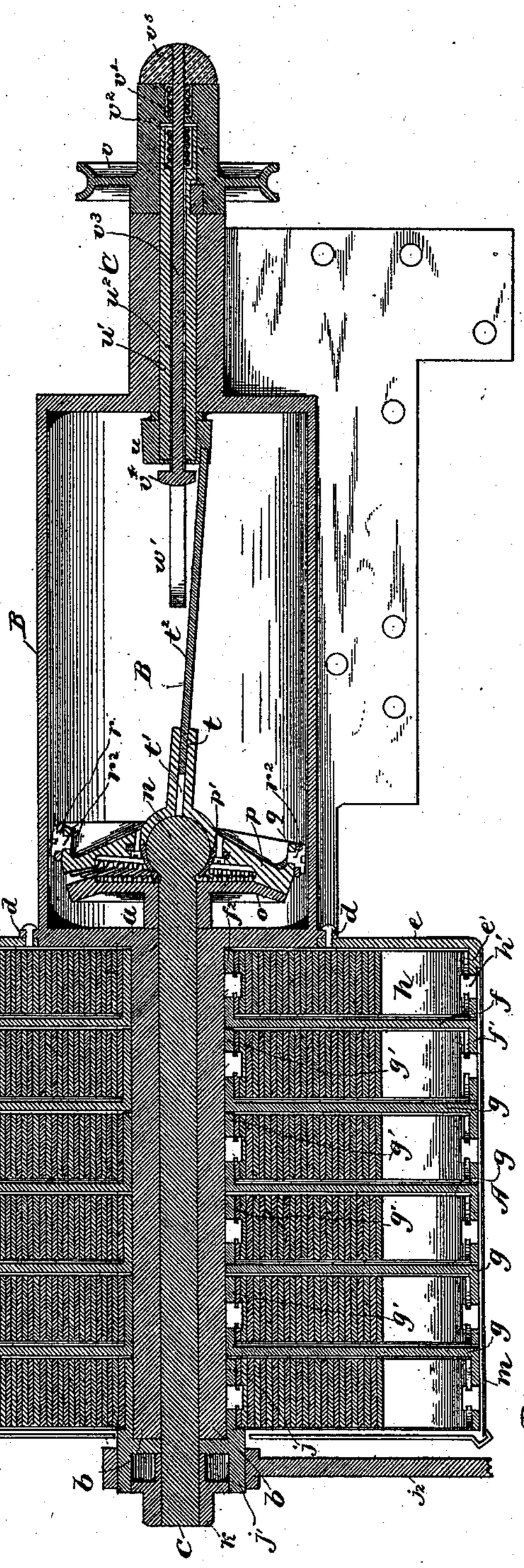
(No Model.) 3 Sheets—Sheet 2.

J. T. MILLER.

SPRING MOTOR.

No. 413,954. Patented Oct. 29, 1889.

Fig. 2.



Witnesses
E. H. Berry.
Frank L. Dyer

Inventor
James T. Miller
by Geo. W. Dyer
Attorney

(No Model.) 3 Sheets—Sheet 3.

J. T. MILLER.

SPRING MOTOR.

No. 413,954. Patented Oct. 29, 1889.

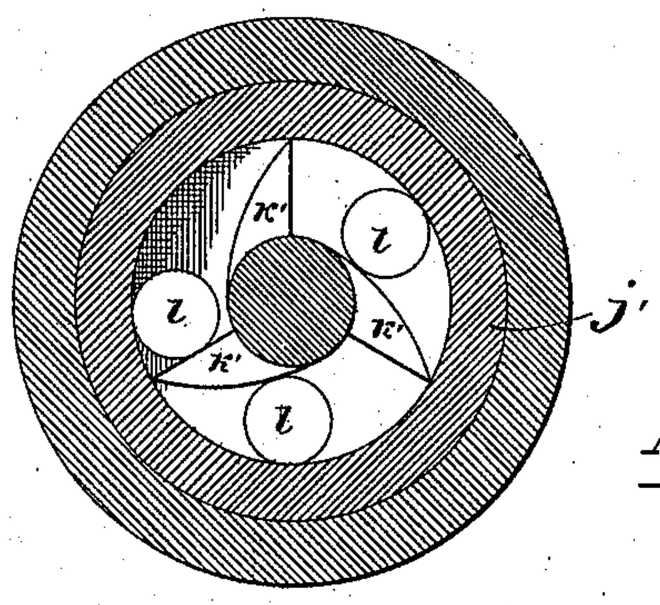


Fig. 4.

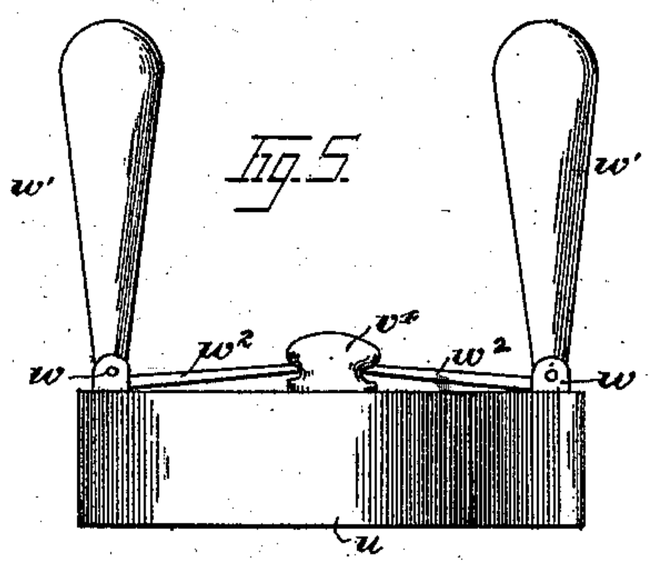


Fig. 5.

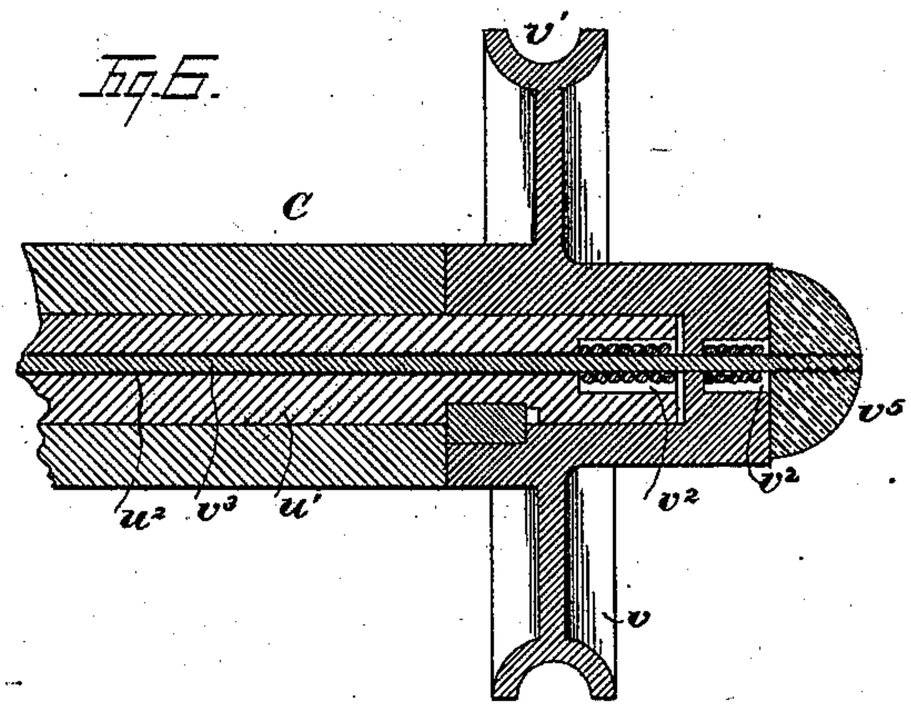


Fig. 6.

Witnesses
C. H. Berry.
Frank L. Dyer

Inventor
James T. Miller
by Geo. W. Dyer
Attorney

UNITED STATES PATENT OFFICE.

JAMES T. MILLER, OF ATLANTA, GEORGIA.

SPRING-MOTOR.

SPECIFICATION forming part of Letters Patent No. 413,954, dated October 29, 1889.

Application filed October 12, 1888. Serial No. 287,895. (No model.)

To all whom it may concern:

Be it known that I, JAMES T. MILLER, a citizen of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented certain new and useful Improvements in Spring-Motors; and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to various new and useful improvements in spring-motors which are especially adapted to the operation of sewing-machines, fly-fans, jewelers' lathes, and, in fact, any variety of machinery requiring but a slight power to operate; and my invention is characterized by its extreme simplicity, thorough effectiveness, portability, and durability, all of which have been demonstrated by practical use.

The objects of my invention are to provide and produce a motor which can be wound in a short time, and when once wound is capable of running several hours; one in which the source of power occupies the least possible space; one which can be readily stopped or started, and one in which the speed will be always practically uniform; and the novelties of my invention consist of a series of coiled springs coupled together side by side and tending to rotate a shaft, a rotating gear-wheel rigidly secured to this shaft, a rocking non-rotatable gear-wheel meshing with said rotating gear-wheel, a device for converting the motion of the rocking gear-wheel into a rotatory motion, a band or pulley wheel operated by such converting device, a governor acting in conjunction with said band or pulley wheel for regulating and making uniform the speed of the same, and a peculiar ratchet device for winding the operating-springs, all of which will be more fully hereinafter described, and which will be embodied in the claims.

I will now proceed to describe my invention, attention being had to the accompanying drawings, wherein like parts are designated by identical letters of reference, and in which—

Figure 1 is a plan view of the whole device, showing the manner of attachment with an ordinary sewing-machine; Fig. 2, a sectional view of the whole device; Fig. 3, a sectional view showing the mechanism whereby the rocking gear-wheel is prevented from rotating; Fig. 4, a sectional view illustrating the ratchet device for winding the springs; Fig. 5, an elevation of the fly-wheel and governor-weights, and Fig. 6 a sectional view on an enlarged scale of the band or pulley wheel and its connections, illustrating the means whereby the device may be stopped and started, and also the mechanism by which the speed of the band or pulley wheel may be always approximately uniform.

From an inspection of Fig. 1 it will be seen that the device consists of a large cylindrical casing A, within which the operating-springs are located, a smaller cylindrical casing or barrel B, within which are situated the multiplying gear-wheels, the converting device for rotating the fly or face wheel and a portion of the governing device, and a still smaller cylindrical casing C, within which the secondary driving-shaft rotates. All of these different parts just enumerated will be described in their regular order.

In most of the spring-motors heretofore used it has been customary to use but one spring, and if the motor is capable of running any considerable length of time it will be seen that this spring must be necessarily very long and bulky, and would thereby render the motor entirely unfit for use on a sewing-machine. By the use of my invention this defect is entirely overcome by simply making use of a number of shorter springs coupled together side by side in a peculiar manner, so that any number of springs will occupy the diametrical space of a single spring.

The forward wall *a* of the casing B is formed with the long hollow cylindrical projection *b*, extending directly out therefrom, and within this projection *b* the main driving-shaft *c* of the device is adapted to operate. Secured rigidly to the flange *d*, made integral with the casing B, is the drum *e*, formed with the overhanging flange *e'*. Placed in juxtaposition to this drum *e* is another drum *f*, provided with an overhanging flange *f'* and with a cylindrical hub f^2, encircling said projection *b* and in a direct vertical line with the flange *e'*. Arranged side by side to the

drum *f* are any number of other drums *g g g g*, identically constructed and mounted on the projection *b*, and these drums are each provided with a hub *g'*, similar to the hub f^2, which extends in a direct vertical line with the overhanging flange of the adjacent drum, as shown in Fig. 2. Before being placed in position on the projection *b* the various operating-springs are first introduced inside of these drums, as follows: Beginning with the drum *e*, one end of the coiled spring *h* is first securely fastened to the overhanging flange *e'* by means of the pin or screw *h'*. The spring is then wound around the projection *b* the requisite number of times and is then secured at its other end to the hub f^2 of the drum *f*, so that it will now be seen that all the power of the spring *h* will be exerted in rotating the drum *f*. The next spring *i* is secured at one end to the flange *f'* of the drum *f* and is wound around the projection *b* in the same direction as the spring *h* and is secured to the hub of the adjoining drum. As all of the other springs are placed in position in identically the same manner, further description regarding this is needless.

When all the springs and drums are in position on the projection *b*, and, with the exception of the drum *e*, are capable of rotating easily on said projection, it will be seen that when wound the spring in each drum will tend to rotate the adjacent drum, so that exactly or nearly the same result is accomplished by using a number of short springs as if one continuous spring of the combined lengths of all were used. The end of the spring in the last or farthest drum is secured to the hub or cylindrical portion *j* of the sleeve *j'*, made of any angular or irregular shape, so that a firm hold will be offered the crank j^2 when placed in position thereon, and within this sleeve is located the ratchet mechanism for winding up the various springs in the respective drums.

Keyed rigidly to the main driving-shaft *c* is a nut or hub *k*, formed on its inner portion with three or more inclined tracks *k' k' k'*, and the extreme outer ends of these tracks extend very nearly to the interior walls of the sleeve *j'*. Adapted to roll easily back and forth on these inclined tracks *k' k' k'* are the metallic balls *l l l*, respectively, made of such a size that when at the lowest portion of each track, or that portion nearest the main axle, such balls will also extend very nearly to the interior walls of the sleeve *j'*. It will now be seen that when the crank j^2 is placed in position on the sleeve *j'* and rotated, so as to wind up the various springs, the balls *l l l* will not interfere with the rotation of said sleeve, but will be caused to roll in a direction toward the lower portion of each track, and the main driving-shaft *c* will thereby remain stationary. After being wound and the crank has been removed the various springs will tend to rotate the sleeve *j'*, and this rotation will cause the interior walls of the sleeve *j'* to engage with one or more of the balls *l l l*, and the said ball or balls will be forced up the inclined tracks, and will thereby become tightly jammed between the sleeve and inclined tracks, so that the hub or nut *k* and the main driving-shaft *c* will be forced to rotate with it.

In order that the drums may be effectively protected from any shock, and to prevent the entrance of any foreign substance, it is advisable to make use of a shield or cover *m*, made preferably of sheet metal, and which may be held rigidly in place by being securely fastened to the immovable drum *e*.

The shaft *c*, which should be made of some very hard metal, is provided at its extreme end inside of the casing B with a ball *n*, preferably made integral with said shaft, though of course this is not strictly necessary. Fastened rigidly to this shaft adjacent to the ball *n* is a beveled cogged wheel *o*, with its teeth so pitched that a line drawn along the top and bottom of each would pass exactly through the center of the ball *n*. Upon this ball *n* another gear-wheel *p* is mounted, and this gear-wheel is what I term a "rocking" gear-wheel, on account of its peculiar motion when in operation. The teeth of both of these gear-wheels are pitched rather more than usual, so that the teeth will slide over each other very readily. The mounting of this rocking gear-wheel on the ball *n* is effected by means of a cap *p'*, partially surrounding said ball *n*, as shown in Fig. 2, and screwed or otherwise secured to the web of the rocking gear-wheel. It will be seen from an inspection of Fig. 2 that the rocking gear-wheel engages with the gear-wheel *o* only at one point, and it will be evident that the rocking gear-wheel is capable of engagement at any point on the periphery of the gear-wheel *o* by simply rocking the gear-wheel *p* on the ball *n*, so that its teeth will engage successively with the teeth at different points on the gear-wheel *o*. In order that the rocking gear-wheel may be prevented from rotating and still not be deprived of its rocking motion, I make use of the device illustrated in Fig. 3. The rocking gear-wheel has cast on its periphery the two integral ears *q q*, each provided with a hole extending entirely therethrough, and the center of each hole is exactly in line with the center of the ball *n*. A yoke D', as shown in Fig. 3, is provided with the semicircular arms *r r*, and with cylindrical projections *r' r'* connecting the same. Extending directly through each arm *r*, at the middle points thereof, and entering the holes in the ears *q q*, is a pin r^2, so that it will now be apparent that the rocking gear-wheel is pivotally mounted with the yoke D'. The projection *r'* is pivotally mounted in the casing r^3 in the side of the casing B, and the center of said projection is exactly in line with the center of the ball *n*. By means of this arrangement it will be evident that the gear-wheel *p* is at liberty to rock freely in all directions on the ball *n*, but cannot partake

of a rotary motion. Cast integrally with the rocking gear-wheel is a long hub or casing t, provided on its interior with a cylindrical chamber t', preferably extending out to the ball n, as shown, in order that the ball may be lubricated, if desired. Fitting tightly inside of this chamber is a rod t^2, whose other end is in loose engagement with an opening or chamber in the face of the face-wheel u. It will be seen that by rotating the face-wheel u the rod t^2 will be caused to rotate with it on a different center, and that this rotation of the rod, communicated by means of the casing or hub t, will cause the gear-wheel p to partake of a rocking motion, so that its teeth will engage, respectively, at succeeding points with the teeth of the gear-wheel o.

The face-wheel u is rigidly mounted on the shaft u', provided with a long cylindrical chamber u^2, extending its entire length, and on the other end of this shaft is mounted the pulley or band wheel v, so as to be deprived of rotary but not lateral movement. This pulley or band wheel is provided with a chamber v', for the purpose hereinafter explained, and a similar chamber v^2 is made in the shaft u' for a like reason. Extending the entire length of the chamber v^2 is a rod v^3, provided at one end with an enlarged head v^4, and at the other end with a screw-threaded portion, with which the thumb-nut v^5 engages. The face-wheel u is cast with the two sets of ears $w\,w$, and pivotally mounted upon each set or pair is a governor-weight w', provided with a right-angled arm w^2, engaging under the enlarged head v^4 of the rod v^3. Inside of the chamber v^2 is a coiled spring encircling the rod v^3 and bearing against the partition which separates said chamber from the chamber v', and in this latter chamber is another spring similarly coiled and bearing against the inside surface of the thumb-nut v^5. The tension of the two springs is sufficiently powerful to normally keep the pulley or band wheel from bearing against the casing C, but when the face-wheel is revolving too rapidly the governor-weights are thrown apart by centrifugal force, thereby elevating the right-angled levers and the rod u' with them, and the band or pulley wheel is thereby forced over against the casing until the friction caused thereby is sufficient to cause the face-wheel to slacken its speed. When the speed has diminished sufficiently, the centifugal force will not be powerful enough to oppose the tension of the two springs, and the band or pulley wheel will thereby be retracted from the casing C. By means of the thumb-nut v^5 the tension of the springs may be easily adjusted and the speed thereby regulated, and when it becomes necessary to stop the device the thumb-nut is forced against the pulley-wheel, so as to press the same tightly against the casing C, and the friction caused thereby will prevent any motion of said pulley-wheel.

The action of the two gears will now be explained. The rocking gear-wheel p has preferably one more tooth than the gear-wheel o, though it will be understood that when very large wheels are used this difference may be made correspondingly greater. In order that the action of these gears may be better understood, I will describe the several coacting parts in a reverse order. First, suppose that the pulley or band wheel is slowly revolved, thereby rotating the shaft u' and the face-wheel u with it. This rotation of the face-wheel u will cause the rod t^2 to move as before described, and this movement of the rod t^2 will cause the gear p to partake of its rocking motion, and its teeth will engage with the teeth of the gear-wheel o at successive points on its circumference. Now, as this rocking gear-wheel has one more tooth than the gear-wheel o, it follows that for every time it makes a complete rocking movement —*i. e.*, has engaged with every tooth on the gear-wheel o—the gear-wheel o will be advanced one tooth. Now, therefore, if the gear-wheel o is made to rotate by the tension of the operating-springs, it will cause the gear-wheel p to perform one entire rocking movement for every tooth which may be advanced on the driving-gear o. Every time the gear-wheel p makes one complete rocking movement the pulley-wheel is rotated once by means of the connecting-rod t^2, and consequently it will be seen that the pulley or band wheel will make as many revolutions while the gear-wheel o is rotating once as the entire number of teeth on such gear-wheel.

In order that the different parts may be lubricated or repaired, if necessary, it might be advisable to hinge the upper portion F of the casing B, so that free access could be readily had with the interior of such casing.

The whole apparatus is adapted to be secured to the sewing-machine or other device by means of bolts or screws passing down through suitable openings in the plate G, and the power from the pulley or band wheel is of course utilized by suitable belting.

Such a device as above described has undergone several practical tests, and it has been found that six springs, occupying a space of less than seven inches in diameter by ten inches in length, have, by means of the two gear-wheels, sufficient power to rotate the pulley or band wheel over seven thousand revolutions, and with ample force to drive any ordinary sewing-machine.

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

1. In a spring-motor, a series of coiled springs arranged side by side and all connected together, in combination with the rotating gear-wheel o, the rocking gear-wheel p, the connecting-rod t^2, and the pulley or band wheel, substantially as herein set forth.

2. In a spring-motor, a series of coiled springs arranged side by side and all connected together, in combination with the main

driving-shaft *c*, formed with a ball *n* thereon, rotating gear-wheel mounted on said shaft, a rocking gear-wheel loosely mounted on said ball, the rod t^2, connected to said rocking gear-wheel, and the pulley or band wheel, substantially as set forth.

3. The combination of the operating-springs, the main driving-shaft *c*, deriving power therefrom, rotating gear-wheel rigidly mounted on said shaft, having the ball *n* formed on the end of said shaft, the rocking gear-wheel *p*, loosely mounted on said ball, the yoke D, embracing said rocking gear-wheel, for the purpose set forth, the connecting-rod t^2, and the pulley-wheel, all combined and arranged substantially as described.

4. The combination of the operating-springs, the sleeve *j*, connected thereto, the hub or nut *k*, fitting loosely within said sleeve and provided with inclined tracks k' k' k', the balls *l l l*, mounted on such inclines, the main driving-shaft rigidly connected to said hub or nut, the rotating gear-wheel mounted on said main shaft, having the ball *n* formed on the end of said shaft, the rocking gear-wheel loosely mounted on said ball, the yoke D, encircling said rocking gear-wheel, the connecting-rod t^2, and the pulley or band wheel, substantially as set forth.

5. The combination of the operating-springs, the main driving-shaft connected therewith, rotating gear-wheel mounted on said shaft, having the ball *n* formed on the extreme end of said shaft, the rocking gear-wheel *p*, mounted loosely on said ball, the rod t^2, connecting said rocking gear with the fly-wheel *v*, the face-wheel *u*, the shaft u', and pulley or band wheel mounted on the same, substantially as set forth.

6. The combination of the operating-springs, the main driving-shaft connected therewith, the rotating gear mounted on said shaft, having the ball *n* formed on the extreme end of said shaft, the rocking gear *p*, loosely mounted on said shaft, the connecting-rod t^2, the face-wheel *u*, mounted on the shaft u', the rod v^3 within said shaft, and the pulley or band wheel mounted on said shaft, substantially as set forth.

7. The combination of the operating-springs, the main driving-shaft connected therewith, the rotating gear-wheel mounted on said shaft, having the ball formed on the extreme end of said shaft, the rocking gear-wheel loosely mounted on said ball, the rod t^2, the face-wheel *u*, the shaft u', the rod v^3 within the same, and the governor-weights acting with said rod, for the purposes set forth, substantially as described.

8. The combination of the operating-springs, the main driving-shaft connected therewith, the rotating gear-wheel mounted on said shaft, having the ball *n* formed on the end of the same, the rocking gear-wheel *p*, mounted loosely on said ball, the connecting-rod t^2, the face-wheel *u*, mounted on the shaft u', the rod v^3 within said shaft, the governor-weights pivotally attached to said face-wheel, coiled springs encircling said rod v^3, for the purposes set forth, and the pulley-wheel mounted on said shaft u', substantially as herein described.

9. The combination of the operating-springs, the main driving-shaft connected therewith, the rotating gear-wheel mounted on said shaft, having the ball *n* formed on the end of the same, the rocking gear-wheel *p*, mounted loosely on said ball, the connecting-rod t^2, the face-wheel *u*, mounted on the shaft u', the rod v^3 within said shaft, the governor-weights pivotally attached to said face-wheel, coiled springs encircling said rod u'', for the purposes set forth, the pulley or band wheel mounted on said shaft u', and the thumb-nut on the extreme end of the rod u'', substantially as described.

10. In a spring-motor, the combination, with a gear-wheel *o*, rotated by means of springs, of a gear-wheel *p*, provided with a different number of teeth from the gear-wheel *o*, oscillatingly mounted on a ball and held from rotation by means of a yoke, substantially as set forth.

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

JAMES T. MILLER.

Witnesses:
WM. H. HULSEY,
W. C. ASHER.