(No Model.) 2 Sheets—Sheet 1.

J. B. POWELL.

SPRING MOTOR.

No. 382,663. Patented May 8, 1888.

FIG. 8.

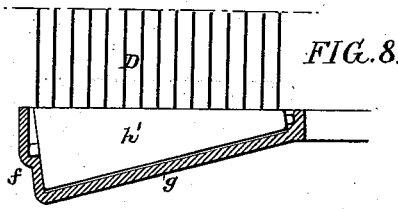


FIG. 9.

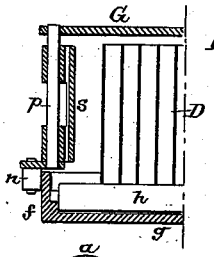


FIG. 1.

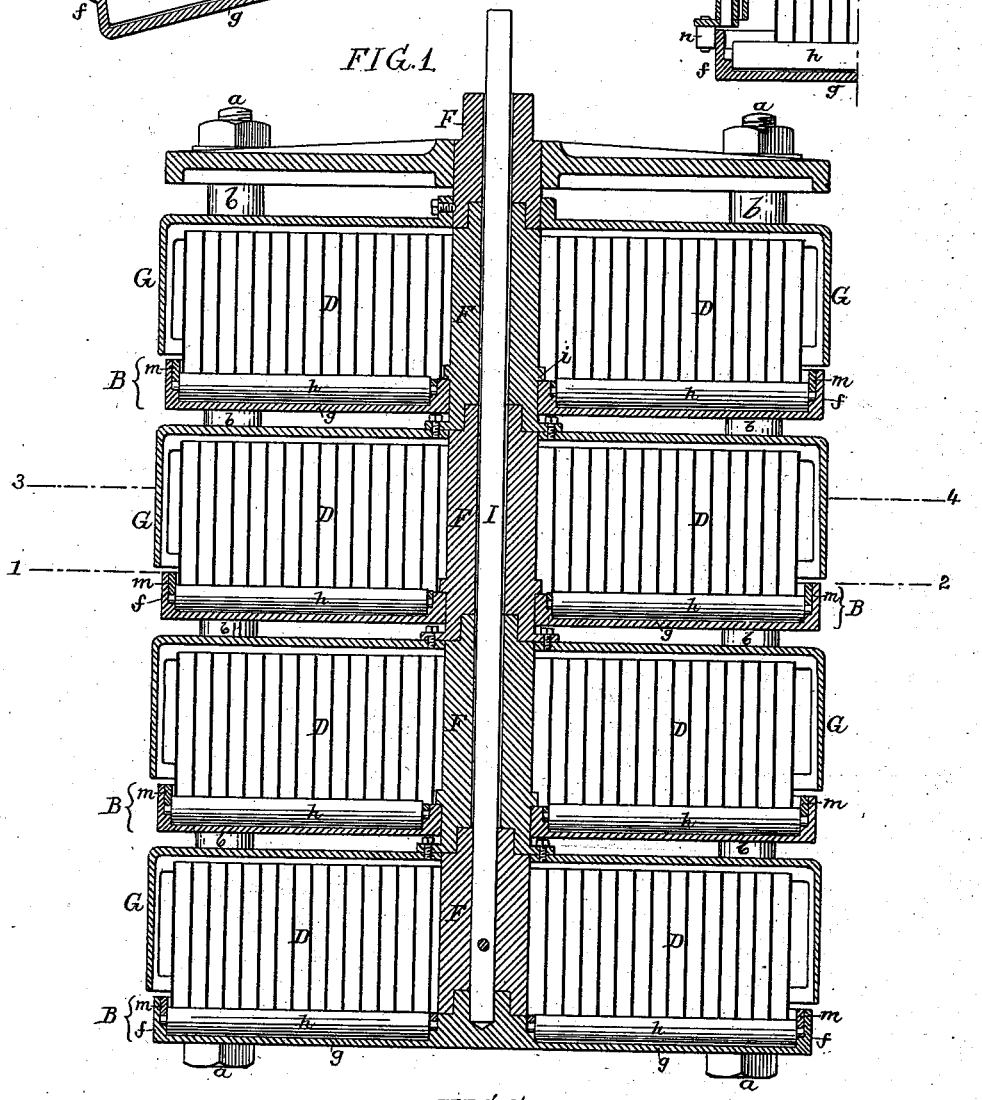
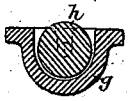


FIG. 7



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(No Model.) 2 Sheets—Sheet 2.

J. B. POWELL.

SPRING MOTOR.

No. 382,663. Patented May 8, 1888.

FIG. 2.

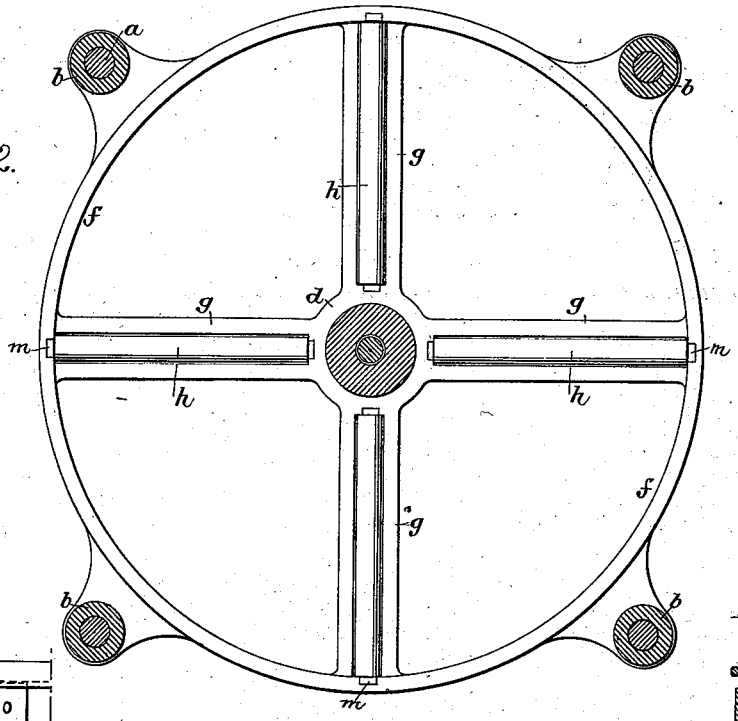


FIG. 5.

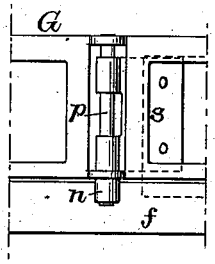


FIG. 6.

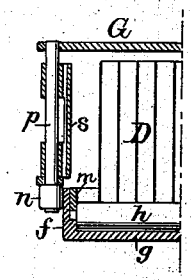
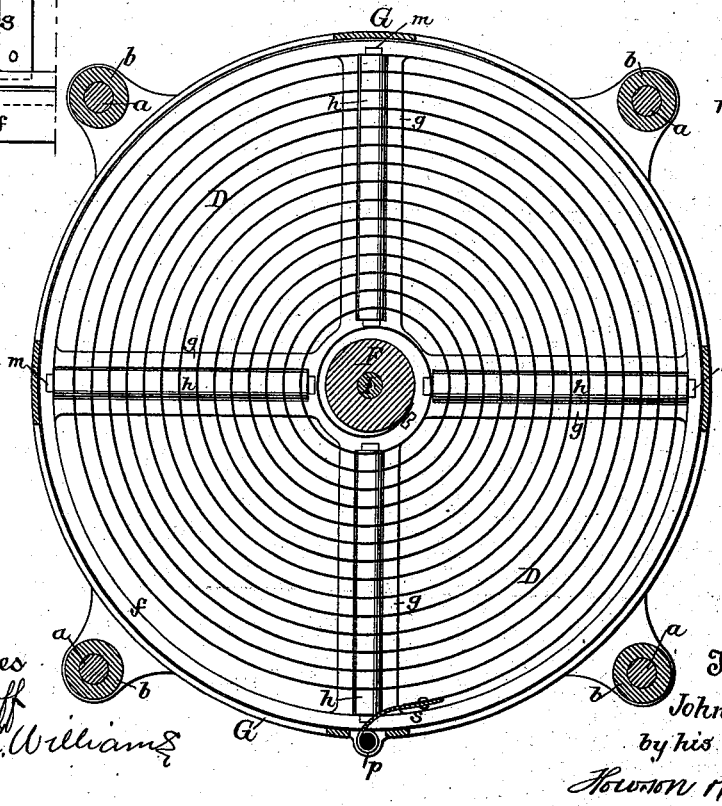


FIG. 3.



Witnesses
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David S. Williams

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UNITED STATES PATENT OFFICE.

JOHN B. POWELL, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-FOURTH TO DANIEL P. DIETERICH AND RICHARD M. POPHAM, BOTH OF SAME PLACE.

SPRING-MOTOR.

SPECIFICATION forming part of Letters Patent No. 382,663, dated May 8, 1888.

Application filed August 20, 1887. Serial No. 247,426. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. POWELL, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Spring-Motors, of which the following is a specification.

My invention relates to that class of spring-motors in which a series of springs located one above another are employed, the objects of my invention being to simplify the construction of the motor and to reduce to a minimum the loss of power due to friction.

In the accompanying drawings, Figure 1 is a vertical section of sufficient of a spring-motor to illustrate my invention; Fig. 2, a sectional plan on the line 1 2, Fig. 1, omitting the spring; Fig. 3, a sectional plan on the line 3 4, Fig. 1; and Figs. 5, 6, 7, 8, and 9, detached views illustrating features of the invention.

The fixed frame of the machine comprises a series of frames or spiders, B, carried by vertical bolts *a*, and separated by filling-pieces *b*, which serve to maintain them at the proper distances apart. Each of the spiders, except the top one, consists of a hub, *d*, a ring, *f*, and a series of radial arms, *g*, the latter being trough-shaped, as shown in Fig. 7, for the reception of rollers *h*, which directly support the springs D, as shown in Fig. 1, each spring being connected at its inner end to one of the sections F of the central hollow shaft or arbor of the machine, and at its outer end to a cage, G, which is connected to and suspended from the section of the arbor above it, and thus forms, practically, a flanged extension of said arbor, so that the successive sections of the arbor may be said to be connected together through the medium of the springs. Each arbor-section is adapted to a bearing in one of the spiders B, and has a flange or collar, *i*, bearing on the hub of said spider, except in the case of the topmost section, which is simply adapted to a bearing in the top spider, A; or it may also have a bearing-collar, if desired.

As all of the springs wind in the same direction, it will be seen that when power is applied to the topmost section, F, of the arbor, to turn the same and cause the turning of the topmost cage, G, so as to wind up the spring connected thereto, the movement will be transmitted through the medium of the spring to the second section of the arbor and to the cage carried thereby, and from the latter through the second spring to the third section of the arbor, and so on, so that the entire series of springs can be wound by power applied to the topmost section of the arbor, the power of the springs in unwinding being transmitted through a central shaft, I, which is secured to the lowest section of the arbor, and passes freely through the sections above the same. As the springs are supported solely by the rollers *h*, the tops of which project above the tops of the radial arms of the spiders, as shown in Fig. 7, very little friction is caused by the rotation of said springs and by the lateral movement due to the expansion and contraction of the same; and as the weight of each section of the arbor and the cage carried thereby is borne, mainly, by the springs to which said parts are connected, there is very little friction due to the bearing of the collars *i* of the arbor-sections on the hubs of the spiders. In fact, these collars may in some cases be dispensed with and the weight of the entire moving part of the structure borne by the rollers *h*.

Each roller has at the ends short journals adapted to recesses in the hub and rim of the spider, the upper ends of the recesses being closed by suitable filling-pieces, *m*, and the troughs may be filled with oil, so that the surfaces of the rollers and their bearings will be constantly lubricated.

When it is desired to compensate for the differences in the rate of movement of the different coils of the spring due to the different diameters of said coils, I use conical supporting-rollers *h'*—such as shown in Fig. 8, for instance—in place of the cylindrical rollers shown in Figs. 1 to 3, so that the supporting-surface of each coil of the spring moves at the same rate of speed as said coil when the spring is rotating.

There is always a lateral pull upon each cage G at the point where the spring is attached to the same, and in order to prevent this from causing any lateral deflection of the cage and its arbor-section—such as would make the lat-

ter bind in its bearing—I provide the cage, at or adjacent to the point at which the spring is connected thereto, with an anti-friction roller, *n*, which has a bearing upon the rim of the spider beneath the cage, and insures the concentricity of the cage with said rim under all circumstances. As shown in Figs. 5 and 6, the roller *n* is carried by the same pin, *p*, to which the end plate, *s*, of the spring is attached, the rim of the spider being slightly less in diameter than the cage; but in Fig. 9 I have shown the roller *n* hung to an extension of the lower bearing for the pin *p*—a plan which may be adopted when the rim of the spider is of the same or of greater diameter than the cage.

It will be evident that simple arms provided at their outer ends with means for the attachment of the outer ends of the springs thereto may replace the cages G, if desired, and such arms are regarded as the equivalent of the cages.

I claim as my invention—

1. The combination, in a spring-motor, of a series of springs, located one above another, with a supporting-frame having rollers upon which the springs are directly supported, all substantially as specified.

2. The combination of a series of springs located one above another, an arbor composed of a series of sections connected together through the medium of the springs, and a supporting-frame having rollers upon which the springs are directly supported, all substantially as specified.

3. The combination of a series of springs located one above another, an arbor composed of a series of sections connected together through the medium of the springs, and a supporting-frame having conical rollers upon which the springs are directly supported, all substantially as specified.

4. The combination of a series of springs located one above another, a frame having a series of spiders, each carrying anti-friction rollers directly supporting the spring above it, and an arbor made in sections connected together through the medium of the springs, and each having a flange or collar bearing upon the hub of the spider, all substantially as specified.

5. The combination, in a spring-motor, of a series of springs located one above another, a fixed frame having annular bearing-rims, a sectional arbor, and cages connected to the arbor-sections and to the outer ends of the springs, and having adjacent to said spring-connections anti-friction rollers having a lateral bearing upon the annular rims of the fixed frame, all substantially as specified.

6. The combination, in a spring-motor, of a series of springs located one above another, a series of supporting-frames, each having trough shaped arms, and rollers mounted in said said trough-shaped arms and directly supporting the springs, all substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN B. POWELL.

Witnesses:

WILLIAM D. CONNER,

HARRY SMITH.