No. 740,114. PATENTED SEPT. 29, 1903.

H. P. FISKE.

SPRING MOTOR.

APPLICATION FILED NOV. 1, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1

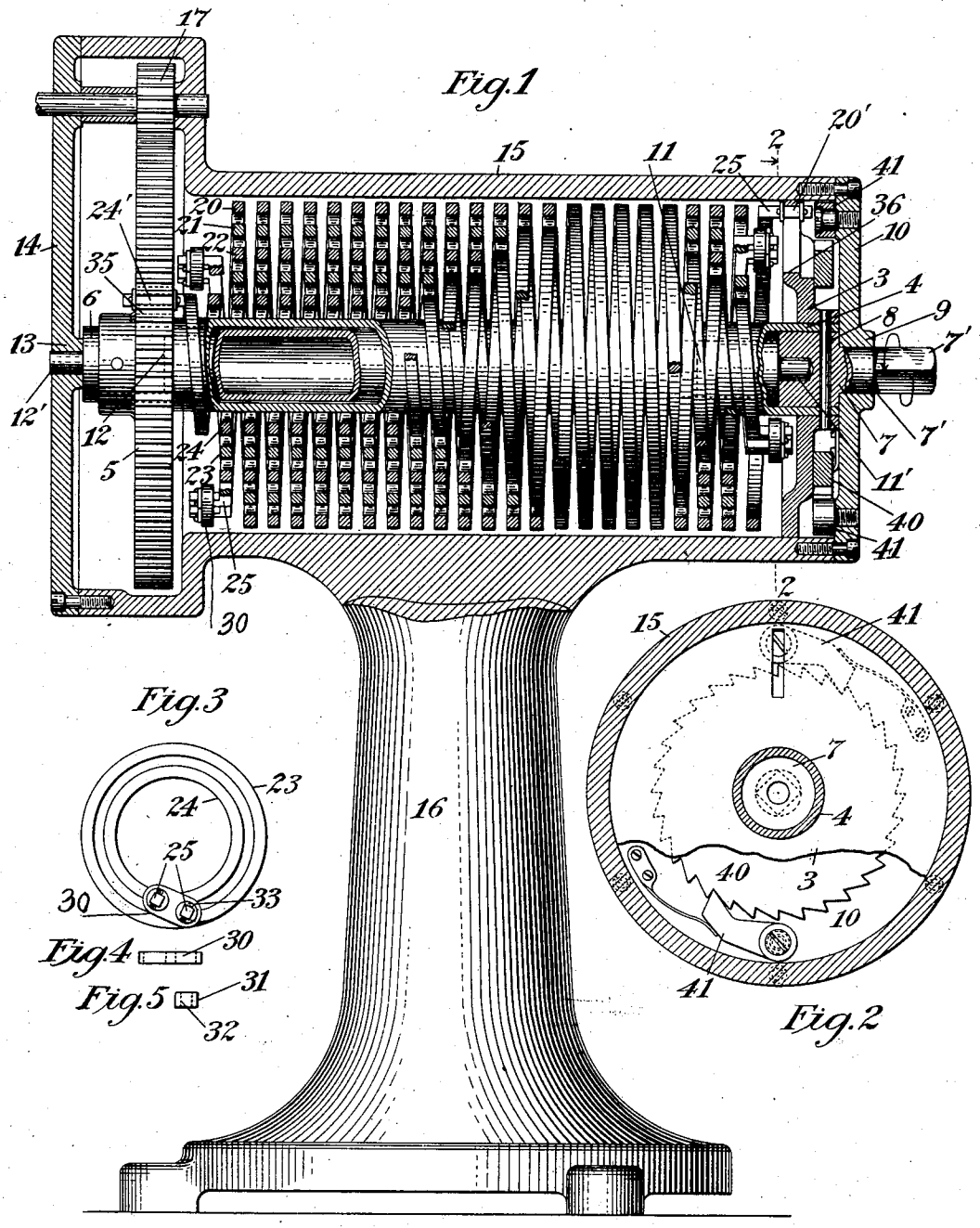


Fig. 3

Fig. 4

Fig. 5

Fig. 2

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 6,

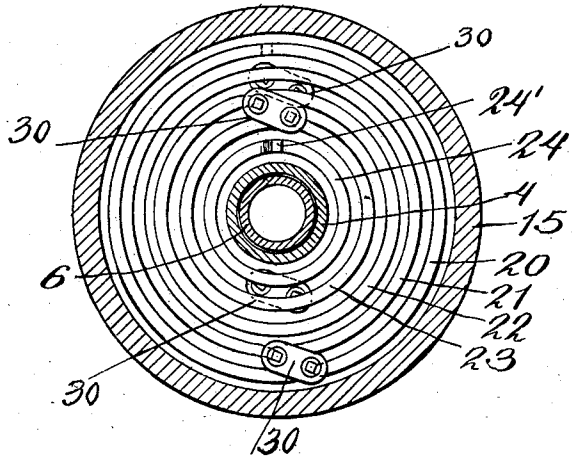
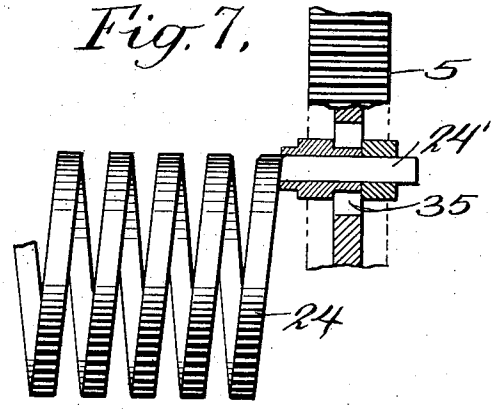


Fig. 7,



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No. 740,114. Patented September 29, 1903.

UNITED STATES PATENT OFFICE.

HENRY P. FISKE, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO NEW YORK SPRING MOTOR COMPANY, OF NEW YORK, N. Y.

SPRING-MOTOR.

SPECIFICATION forming part of Letters Patent No. 740,114, dated September 29, 1903.

Application filed November 1, 1902. Serial No. 129,773. (No model.)

To all whom it may concern:

Be it known that I, HENRY P. FISKE, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Spring-Motors, of which the following is a specification.

This invention relates to spring-motors; and its main object is to provide a motor of this type in which the spring is so constructed as to be capable of storing within a given space the maximum amount of power and transmitting the largest possible percentage of such power to a driven member. For the purpose of accomplishing these results I make use of a spring consisting of a plurality of helices, each independent in construction of every other and all so connected as to form a continuous spring adapted to be wound as a single spring and to store and transfer power as such and having its elements separably connected in such a manner as to permit free transverse expansion and contraction of all the helices. When a plurality of such helices are assembled around a common center and properly placed with respect to one another, the spring may be wound up until the coils of all of the helices are in bearing engagement and constitute a solid rod or tube, this mode of organizing the elements of the spring permitting a given space to be completely filled by such spring when wound up, and hence permitting the maximum amount of metal to be contained in such space and subdivided into separate concentric helices, each consisting of a large number of individual coils or turns. In order that the spring alone may fill such space completely without interference of the coils of the separate helices, I make use of a plurality of helices, the coils of which alternate in direction and are rectangular in cross-section, the alternation of the direction of running of the coils serving to permit each helix to be guided by another and to have a bearing on another when the spring is fully wound up, while the cross-section of the coils enables the helices to completely fill a given space when the spring is tightly wound.

In the drawings accompanying this specification and forming part of the present application, Figure 1 is a sectional elevation of a spring-motor constructed in accordance with my invention and mounted in a suitable casing. Fig. 2 is a transverse section of one end of the motor and its casing, the section being taken in line 2 2, Fig. 1. Fig. 3 is a detail illustrating in end elevation a pair of concentric helices and the mode of connecting the same. Figs. 4 and 5 are details of the link and roll, respectively, which I employ for connecting the separate helices of the spring. Fig. 6 is an end view of the helices. Fig. 7 is a view, partly in section, on an enlarged scale, showing the manner of connecting the inner helix to the driven member.

The spring constituting the main element of my improved spring-motor and constructed in accordance with my invention consists, essentially, of a plurality of concentric separate helices connected by suitable devices to form a continuous spring, the ends of which are connected, respectively, to a resistance point or member and a driven member. It is sufficient if the spring and the resistance and driven members are so organized that the driven member is movable relatively to the resistance member to transmit the power stored in the spring; but the resistance member in the ordinary construction of the motor will usually keep a fixed position during the operation of the motor and will only be movable for the purpose of winding the spring. These resistance and driven members may be of any suitable construction, the former being in the present case a disk 3, secured to a tubular shaft or spindle 4, while the driven member may be a wheel or gear, such as 5, secured to a shaft or spindle, such as 6, mounted in this case within the spindle 4 and also preferably tubular. The end of the spindle 4 adjacent the resistance member proper or disk 3 is closed in the present construction by a plug 7, to which the disk 3 and the spindle 4 are keyed by means of a pin 8. The outer end of this lug is reduced at 7′ to form a journal portion, which is mounted to turn in the bearing 9 in one end 10 of the casing containing the spring. At its extreme end the plug 7 may be squared, as shown at 7″, to receive a

key or crank, by means of which the plug and the resistance member may be turned to wind up the spring.

At the winding end of the spring-motor the driven spindle 6 is also, preferably, plugged, as shown at 11, and the outer end of the plug is reduced to form a journal 11′, which works in a bearing in the inner end of the plug 7. At the driven end of the motor the outer spindle terminates at the inner side of the gear-wheel 5 and its cheek bears against the gear, the hub of this gear being pinned to the inner spindle 6 and to a plug 12, which fills the end of said inner spindle and is reduced at its end to form a journal 12′, which works in a bearing 13 in a cap 14 at the opposite end of the casing 15 from the cap 10. These two caps 10 and 14 are removably secured to the body 15 of the casing, as by means of set-screws, and the body portion 15 of said casing is formed in this construction in one piece with a post or upright 16. From the gear 5 the movement of the motor may be transmitted to any other suitable driven member or members, such as the pinion 17 and its spindle.

In the construction shown five concentric but separate helices, designated, respectively, by 20, 21, 22, 23, and 24, encircle the spindle 4 and are connected at their ends in such a manner that the five helices constitute a single continuous spring, one end of which is connected to the resistance-disk 3, while the other end is connected to the gear 5. Here the outer helix 20 is connected to the resistance member, by means of which the spring is turned in winding, and the opposite end of the inner helix 24 is connected to the gear 5. At each end thereof each helix is so shaped as to be readily attached to a connecting member or link, and for the purpose of connecting the helices easily and permitting the link to turn freely at each connecting-point about a pair of axes parallel with the axis of the spring I prefer to form each helix with end portions, such as 25, bent at approximately a right angle to the turns of the helix in parallelism with the axis thereof. Each helix in this construction is formed from wire of the same gage, which is rectangular and preferably square in cross-section, and hence the spring when its elements are assembled consists, essentially, of five helices of different diameters having substantially the same number of coils or turns in each, which coils are of like cross-section. It will be noticed that the pairs of helices are connected alternately at opposite ends of the spring, the helices 20 and 21 being connected at the left-hand end of the motor, the helices 21 and 22 at the right-hand end, the helices 22 and 23 at the left-hand end, and 23 and 24 at the right-hand end.

In connecting the separate helices of the spring it is important to make the connection in such a manner as to permit each helix so connected to expand and contract transversely relatively to the other to enable the spring to be wound up tightly until all of the helices are in bearing engagement with one another. In order to accomplish this result, connections between the helices are made by extending the ends 25 beyond the ends of the last coils thereof and pivotally joining these ends. A simple short link will be sufficient to accomplish this result in some cases; but when the spring is made in the preferred form—that is, from wire of square cross-section—I find it necessary to provide in addition to a link, such as 30, a pair of rolls, such as 31, having journal-surfaces which coöperate with corresponding bearings or openings in the link 30, so as to be capable of turning freely with respect to the link. Each of these rolls has a squared opening extending therethrough, as shown at 32, of the same cross-section as the squared end of the corresponding helix, which squared end is passed through the opening in the roll and may be held in place by a pin 33. When the helices are connected in this manner, it will be evident that in all positions thereof they are free to move or turn in either direction, according as the spring is being contracted by winding or expanded in doing work. These links also unite all of the helices into a single continuous spring in such a manner that the pull of each helix is transmitted to the connected portion of the adjacent helix evenly and without twisting or otherwise distorting the parts. It will be noticed also that these connections do not interfere in any way with the free winding or unwinding of the helices, as in every instance they are located outside the end coils of the helices which they connect, and the links themselves are preferably short and in no case extend beyond the outer diameter of the connected coils.

The helices of my improved spring-motor are wound alternately to the right and the left, and hence it is impossible for the coils of any helix to get between those of the adjacent helix. Moreover, the parts are so proportioned that when the spring is fully wound—that is, when there are no spaces between the coils of any helix—there will also be no spaces between the separate helices, and hence the inner surfaces of the coils of each helix, beginning with the outer one, 20, will bear against the outer surfaces of the coils of the next adjacent inner helix. When wound to this extent, each helix will have twice as many coils or turns as when in the unwound condition shown in Fig. 1.

In order to accommodate the transverse expansion and contraction of the inner and outer coils at the points where they are connected to the gear 5 and the resistance-disk 3, sliding connections between such members and the ends of said helices are provided. A somewhat shallow slot, the inner wall of which is indicated at 35, is sufficient for permitting play of the end 24′ of the coil 24, because the inner helix moves but a short distance transversely to engage the spindle 4 when such

helix is wound tightly. The opposite end of the outer coil 20 has a considerable range of movement, however, and the slot 36 in the disk 3 is quite deep in order to accommodate this movement. Both the end 24′ of the helix 24 and the end 20′ of the helix 20 are suitably guided and pinned to prevent twisting of the ends of the wires during their sliding movements.

For the purpose of holding the spring under tension after it is wound any suitable means may be employed, that shown herein consisting of a ratchet-wheel 40, secured to the disk 3, and a pair of spring-pressed pawls 41, which in this case are pivoted on the inner side of the cap or end wall 10 of the casing.

From the foregoing description of my improved spring-motor it will be seen that the construction is such that the spring contains a maximum amount of metal in a given space and that this amount of metal is divided into helices and coils capable of storing maximum power. Owing to the further fact that the diameter of such a spring is relatively small as compared with its length it will be seen also that substantially all of the power of this spring is utilized in doing work and is not wasted, as is the case in ordinary clock-springs, which are narrow and of large diameter, by the binding of the coils as a result of lateral torsion in the spiral.

What I claim is—

1. In a spring-motor, the combination of a plurality of concentric separate helices pivotally connected to form a continuous spring the ends of which are connected respectively to a resistance-point and a driven member.

2. In a spring-motor, the combination of a plurality of concentric separate helices the coils of which have squared end portions, rolls having squared openings for receiving said squared end portions, and links having bearings for said rolls and connecting pairs of adjacent rolls to form a continuous spring the ends of which are connected respectively to a resistance-point and a driven member.

3. In a spring-motor, the combination of a plurality of concentric separate helices the coils of which are square in cross-section and have squared end portions substantially parallel with the axis of the helices, rolls having squared openings for receiving said squared end portions, and links having bearings for said rolls and connecting pairs of adjacent rolls to form a continuous spring the ends of which are connected respectively to a resistance-point and a driven member.

4. In a spring-motor, the combination of a plurality of concentric separate helices the coils of which are square in cross-section and alternate in direction and have squared end portions substantially parallel with the axis of the helices, rolls having squared openings for receiving said squared end portions, and links having bearings for said rolls and connecting pairs of adjacent rolls to form a continuous spring the ends of which are connected respectively to a resistance-point and a driven member.

5. A spring-motor comprising a plurality of concentric helices, said helices being detachably secured to each other to form a continuous spring, the ends of said spring being connected respectively to a resistance-point and a driven member.

6. In a spring-motor the combination of a plurality of concentric helices pivotally connected to form a continuous spring, adjacent helices being coiled in opposite directions, and the ends of said spring being connected respectively to a resistance-point and a driven member.

7. In a spring-motor the combination of a plurality of concentric helices, said helices being pivotally connected at opposite ends to adjacent helices to form a continuous spring, the outer and inner ends of said spring being connected respectively to a resistance-point and a driven member.

8. In a spring-motor the combination of a plurality of concentric helices pivotally connected to form a continuous spring, a resistance member and a driven member, and sliding connections between said members and the ends of said spring.

Signed at New York, in the county of New York and State of New York, this 3d day of October, A. D. 1902.

HENRY P. FISKE.

Witnesses:
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MORRIS S. HART.