(No Model.)

4 Sheets—Sheet 1.

G. F. GODLEY.

SPRING MOTOR.

No. 299,978. Patented June 10, 1884.

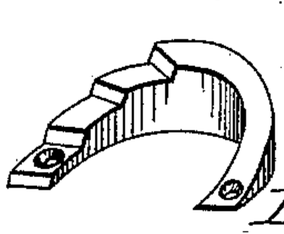

Fig. 2.

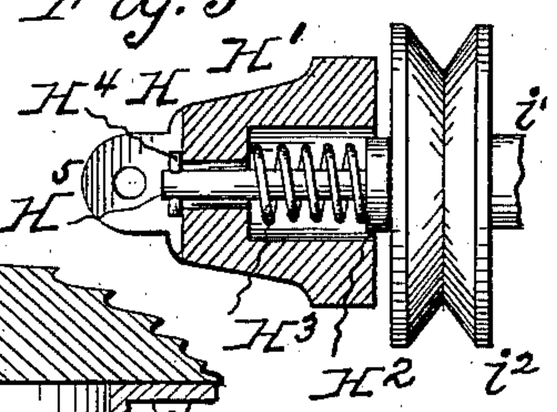

Fig. 3

Fig. 1

Fig. 4

WITNESSES:

Chas. F. Pike

C. W. Williams

INVENTOR,

George F. Godley

By S. J. Van Stavoren

ATTORNEY.

(No Model.)

4 Sheets—Sheet 2.

G. F. GODLEY.

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Fig. 5

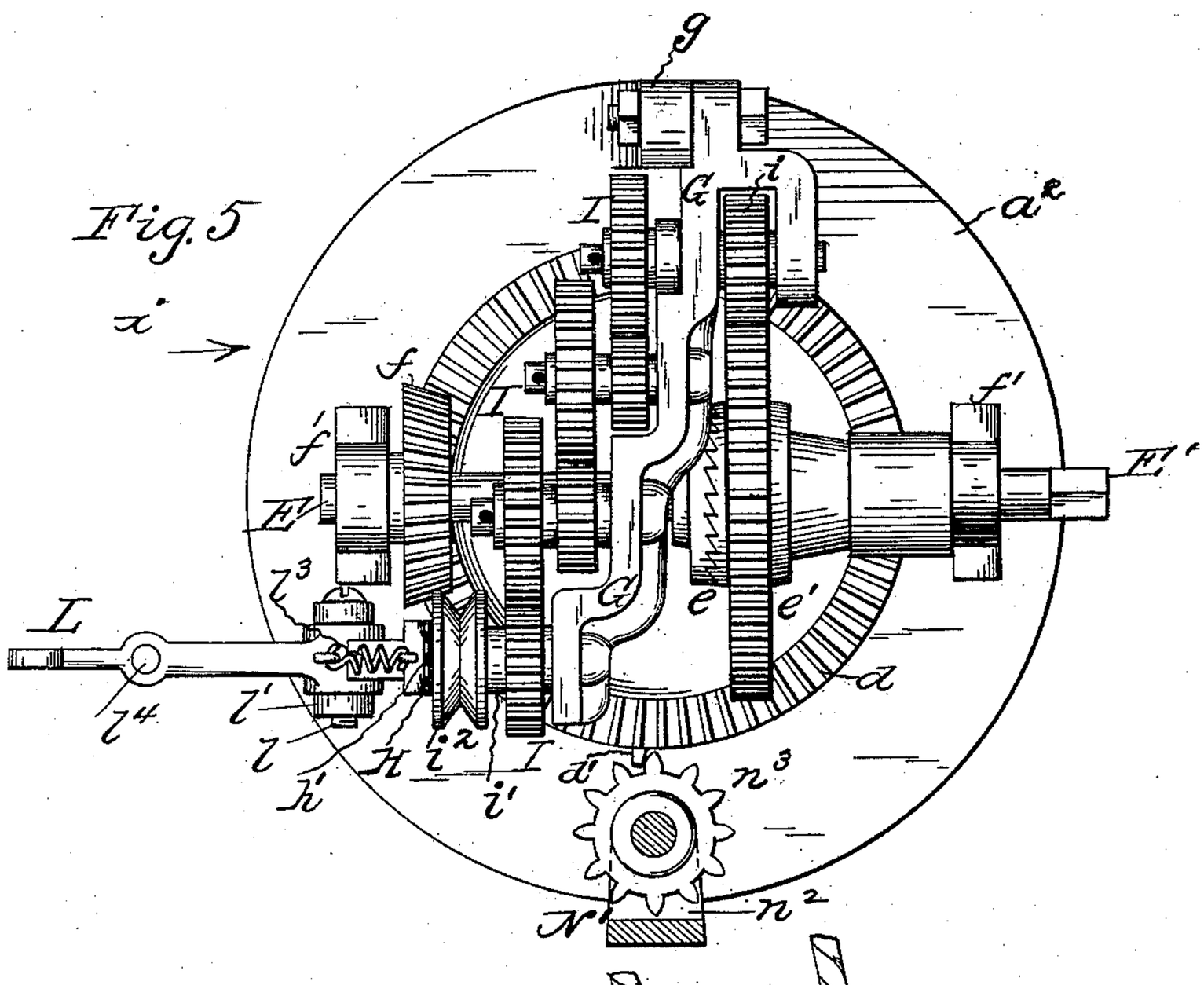
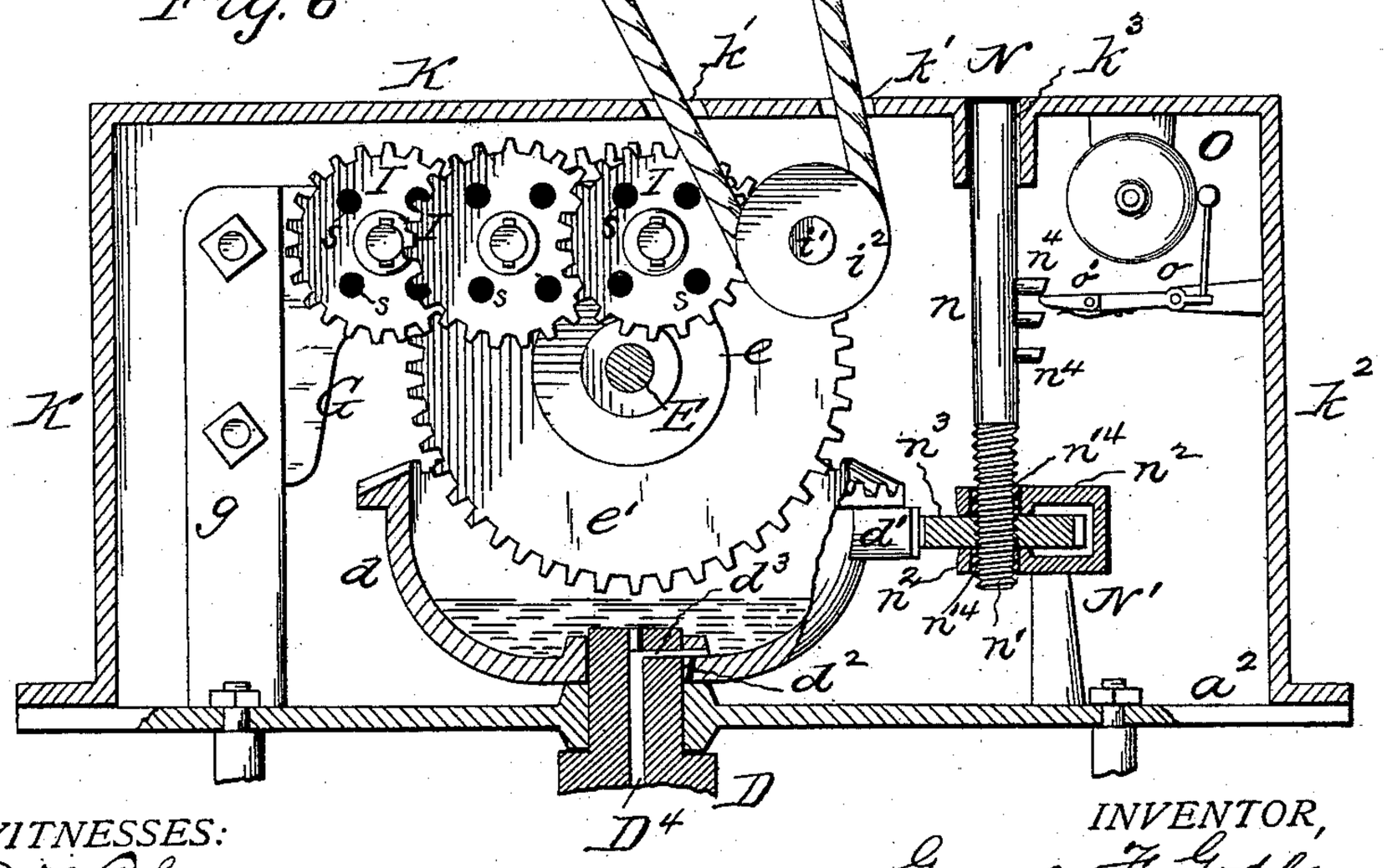


Fig. 6



WITNESSES:

Chas. D. Peko

C. W. Williams

INVENTOR,

George F. Godley

By S. J. VanStavoren

ATTORNEY

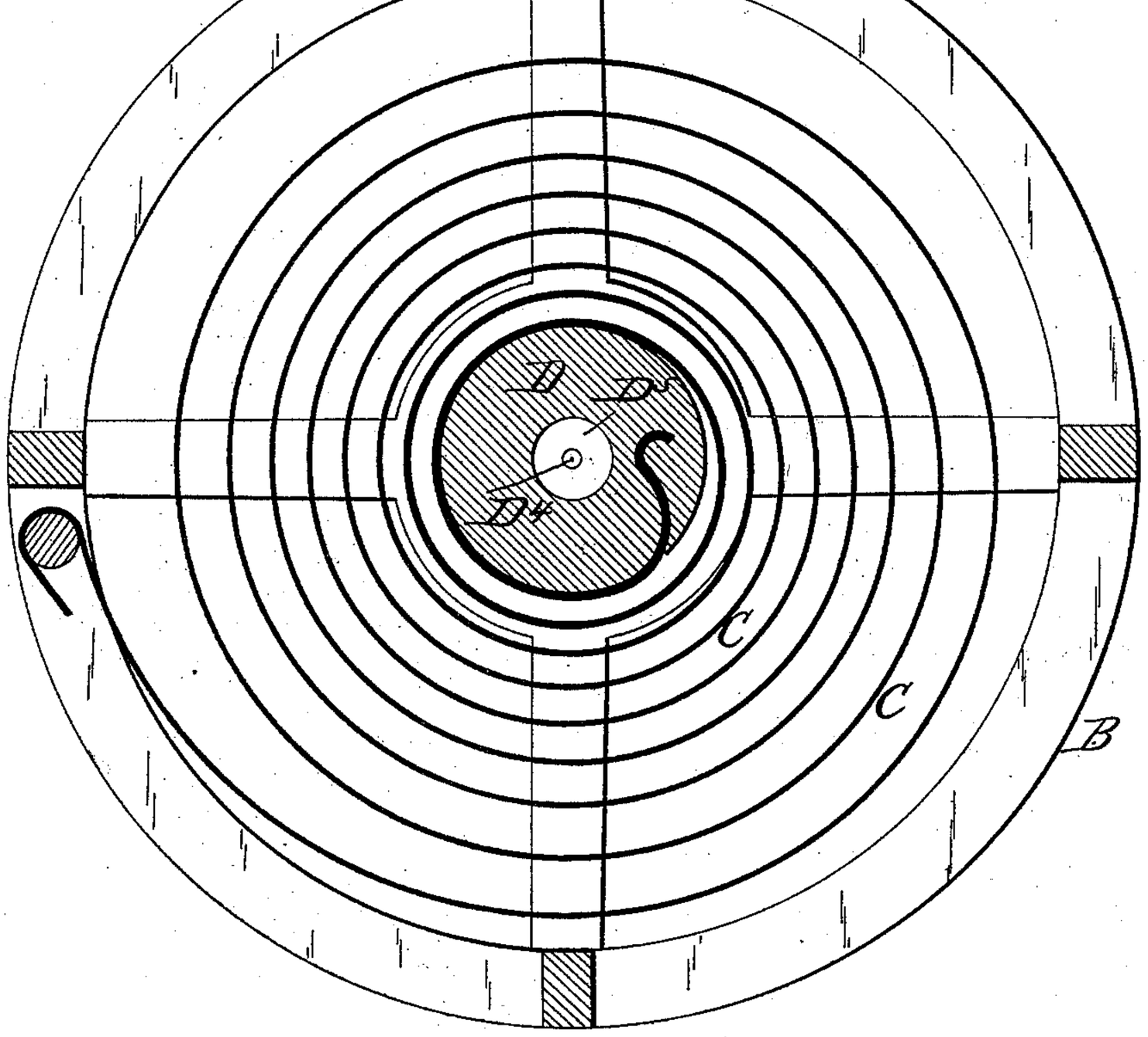
(No Model.) 4 Sheets—Sheet 3.

G. F. GODLEY.

SPRING MOTOR.

No. 299,978. Patented June 10, 1884.

Fig. 7



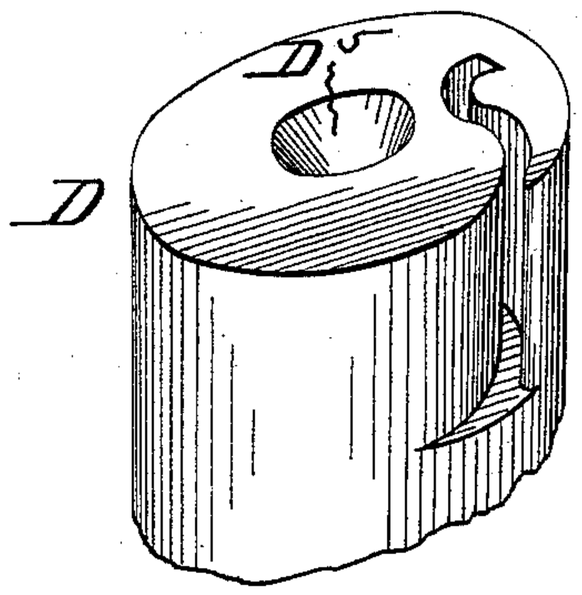


Fig. 8

WITNESSES:
Chas. F. Pike
C. W. Williams

INVENTOR,
George F. Godley
By S. J. Van Stavoren
ATTORNEY,

(No Model.)

4 Sheets—Sheet 4.

G. F. GODLEY.

SPRING MOTOR.

No. 299,978. Patented June 10, 1884.

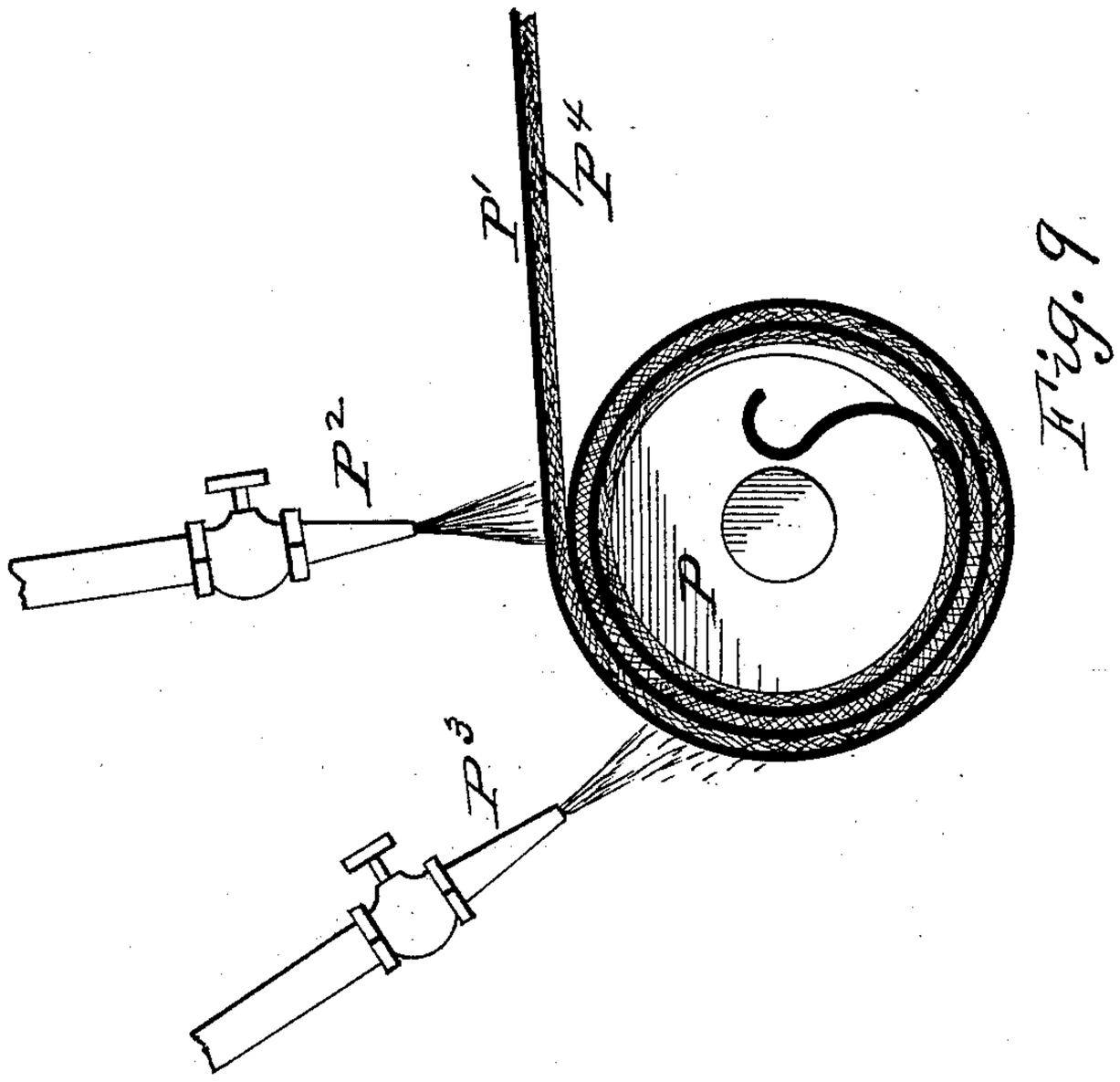


Fig. 9

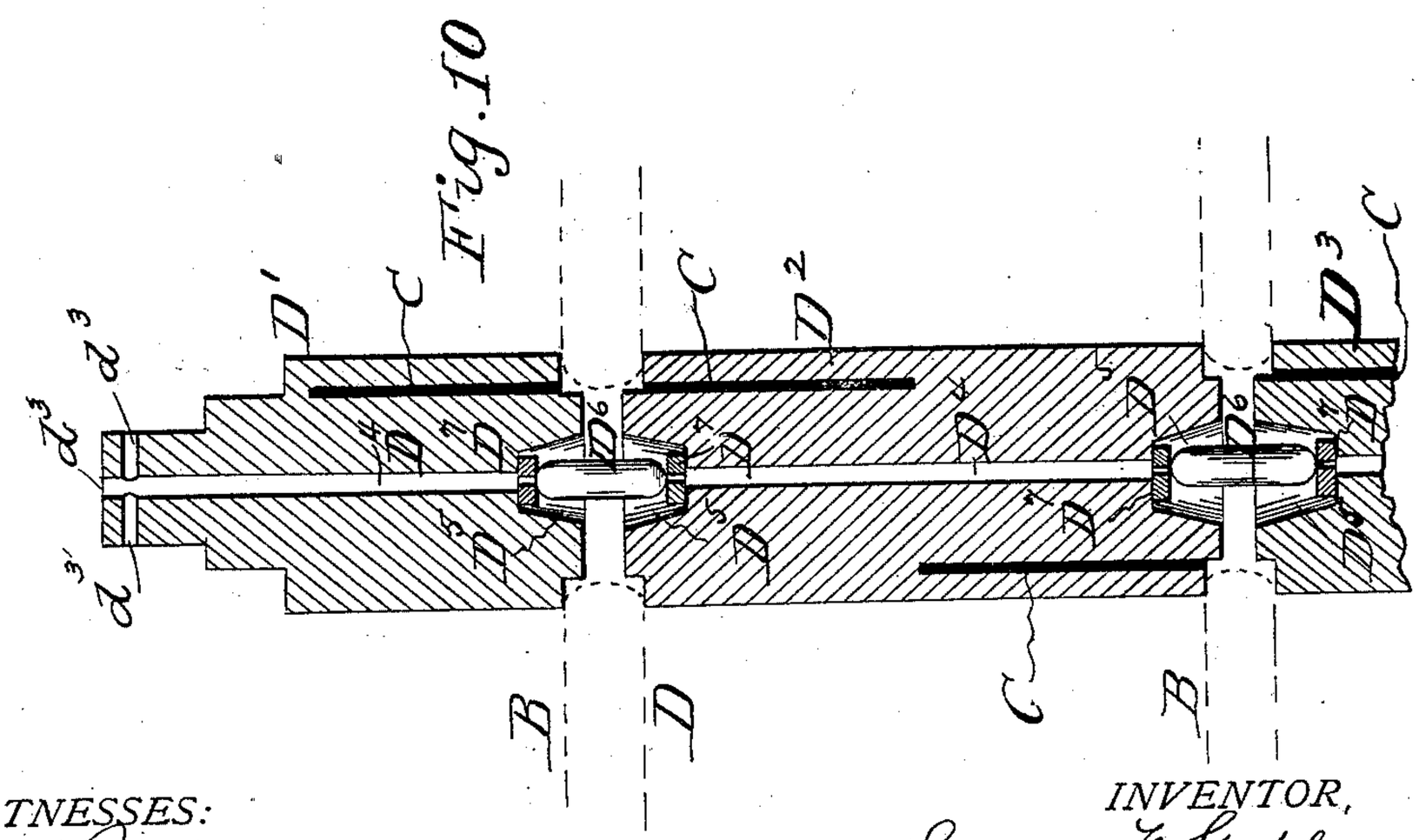


Fig. 10

WITNESSES:
Chas. F. Pike
C. W. Williams

INVENTOR,
George F. Godley
By S. J. Van Stavoren
ATTORNEY.

UNITED STATES PATENT OFFICE.

GEORGE F. GODLEY, OF PHILADELPHIA, PENNSYLVANIA.

SPRING-MOTOR.

SPECIFICATION forming part of Letters Patent No. 299,978, dated June 10, 1884.

Application filed February 28, 1884. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. GODLEY, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Spring-Motors, of which the following is a specification, reference being had therein to the accompanying drawings, wherein—

Figure 1 is a vertical transverse section of a spring-motor embodying my invention. Fig. 2 is a detail perspective. Fig. 3 is a detail sectional view of a modified form of brake-shoe for the motor. Fig. 4 is a detail elevation showing eccentric or crank rod connection for transmitting the power of the motor to a driven shaft. Fig. 5 is a top view of the motor. Fig. 6 is an elevation, partly sectional, of Fig. 5, looking in the direction of arrow *x*. Fig. 7 is an enlarged sectional plan of cage, mandrel, and spring, illustrating the end connections of the spring with its respective cage and mandrel. Fig. 8 is a broken perspective of a mandrel. Fig. 9 is an elevation, partly sectional, showing the manner of coiling or winding and tempering the motor-springs; and Fig. 10 is a vertical transverse section of the sectional mandrel.

My invention has relation to improvements on the spring-motor for which United States Letters Patent were issued on the 5th day of February, 1884, and numbered 292,970; and it has for its objects to arrange and locate the train of multiplying-gearing and journal or supporting-brackets therefor, so as to make the motor more compact and admit of the use, on its last or end shaft, of a belt or eccentric-rod connection for transmitting the power of the motor to the machine or apparatus to be driven; to provide a graduated frictional-surface brake for the motor, whereby its speed or expenditure of its power or degree of unwinding of its springs is more readily and easily controlled, regulated, and varied, as desired, and undue friction between the braking-surfaces avoided, and the power of the motor economized; to make the brake-shoe self-lubricating; to furnish it with operating devices adapted to be moved either by hand or foot pressure, and which maintain it in partial or complete engagement with its brake-wheel, to cause the motor-springs to unwind at any desired speed or power for a longer or shorter interval of time within their capacity; to provide the motor-winding device with either a visual or audible signal, or both combined, for indicating sufficient winding of the motor-springs to prevent overwinding, and consequent setting of the same; to provide an improved mandrel; to secure the inner end of the springs to the mandrel in such manner that said end will not disengage itself from the mandrel when the springs expand or unwind; to provide a cheap motor-spring of great power and durability; to make the springs of different capacity by varying their degree of temper; to furnish the motor with noiselessly operating or transmitting wheels or gearing; to make the motor portable, so that it can be placed in gear with the driven machine without requiring special adaptation of either of said devices to the other; to provide a cap or cover for the transmitting mechanism of the motor; and, finally, to produce a simpler, cheaper, more effective, and durable spring-motor than has heretofore been made.

My invention accordingly consists of the combinations, constructions, and arrangements of parts for effecting the above-described objects, as hereinafter more fully described and claimed.

In the drawings, A represents the motor, composed of a frame, *a*, removable casing *a'*, cages B, springs C, and sectional mandrel-shaft D, having oil, winding, and driving wheel *d*, meshing with gear *f* on shaft E, supported in brackets *f' f'*, and having clutch *e* and gear-wheel *e'*. All of said parts, except as hereinafter noted, are shown constructed and arranged substantially as set forth and illustrated in the aforesaid patent, and need not therefore be more particularly described. If desired, however, they may be otherwise made and disposed as desired, or as deemed expedient and found convenient.

In the above-recited patent the train of transmitting or multiplying wheels and their supporting-bracket are placed in a vertical position, and the end shaft thereof has an eccentric device for detachable engagement with the driving-shaft of the driven machine. This vertical disposition of said parts unduly increases the height of the motor and produces a want of compactness of the parts compos-

ing the same, so that when it is applied to a sewing or other like machine the table of the latter requires cutting or other suitable manipulation to admit of the passage and projection above it of said train of multiplying-wheels. Again, such disposition of the latter, together with the employment of said detachable eccentric engagement, prevents the use of a driving belt or chain, or an undetachable eccentric or crank rod connection on the end or last shaft of the motor or its multiplying-wheels. To avoid these objections I horizontally locate bracket G, with its train of wheels I, at right angles to and immediately above the shaft E, so that its wheel e' will mesh with the first wheel, i, of train I, as plainly shown in Figs. 1 and 5, and the end shaft, i', thereof is provided with a band or belt pulley, i^2, of any desired diameter. The bracket G is screwed or otherwise suitably fastened to a stanchion or post, g, cast on or attached to top plate, a^2. By so arranging the bracket G and its train of wheels I the height of the motor is much reduced, its running-gear made more compact, it can be applied to a sewing or other similar machine without necessitating cutting or mutilation of the table thereof, and the usual belt or band employed in said machines can be utilized for transmitting thereto the power of the motor.

I have shown the bracket G arranged at right angles to the shaft E; but I do not confine myself thereto, as it is obvious that the former may be placed parallel with the latter.

The band or belt wheel i^2 is illustrated secured to shaft i' at its extreme end, and I prefer to so locate said wheel, in order that a brake-shoe, H, to be hereinafter described, may be more readily applied to one of the sides of wheel i^2; but it is evident that the latter may be otherwise located, as desired. The wheel i^2 may be grooved for a round or square belt, as shown; or a flat band or belt pulley or a sprocket-wheel and drive-chain may be substituted; or, in lieu of any of said wheels, the shaft i' may be provided with an end crank or eccentric, I′, having a connecting-rod, I^2, for engagement with an eccentric on the driven shaft, as shown in Fig. 4.

The train of gearing I may consist of meshing toothed wheels, as illustrated, or of friction, band, chain, or other suitable wheels, as desired.

The brake-shoe H is represented as being oblong in outline; but it may be otherwise suitably configured for engagement with the adjoining hub or side of the wheel i^2. If desired, however, the shoe H may be applied to the periphery of said hub, or to a collar on shaft i'. The shoe H is pivoted at h to a bell-crank lever, L, fulcrumed at l on a standard, l', formed on or attached to top plate, a^2; and L′ is the actuating-spring for moving lever L and shoe H to maintain the latter in frictional or braking engagement with wheel i^2, to stop and to modify the force or speed of the unwinding of the motor-springs to suit the requirements of the driven machine. The lever L is provided with a stirrup, L^2, which, if desired, may be made in two parts adjustable upon one another to admit of varying its length; or a treadle mechanism may be substituted therefor. Said lever is also provided with a hand or push rod, M, to be hereinafter more particularly described. Said lever may therefore be depressed or moved by the application of either hand or foot power to stirrup L^2 and push-rod M, respectively, to modify the force of the brake. It will be noticed, therefore, that the power of the brake herein described, as well as that shown in the above-recited patent, is modified by counteracting or varying the force or influence of its actuating-spring, or that applied to the brake-lever; but in said patent the brake-shoe is so constructed that its entire braking-surface, except when not applied or out of engagement, is always in contact with its brake-wheel under all the varied modifications of force of the brake or that exerted by its actuating-spring. It follows, therefore, that the surface of contact between the parts of the brake is constant and only its force or pressure is varied, the result whereof is that there is too much frictional or braking surface for the power of the motor to overcome when it is running slowly, and when the power of its springs is weakening, thereby involving a waste of motor-power. At such times the parts of the brake frequently stick or adhere together, and such action prevents easy and rapid manipulation of the brake to evenly modify its force when the speed of the motor is to be varied. To overcome this adhesion of the parts of the brake sufficient power must be applied to its lever to suddenly withdraw said parts from one another, and then, in like manner, to place them in braking-contact. This action produces either a too quick acceleration or a too sudden arresting of the speed of the motor, and gives a fitful or irregular motion to the operating parts of the driven machine.

In my present invention I avoid the foregoing-described objections by providing means for varying the extent of the braking-surface, as the power or force of its actuating-spring is modified to effect a variation in the speed of the motor, or when its springs are weakening. This result I obtain by either connecting the top or one edge of the shoe H to lever L or other suitable fixture of the motor, by means of a contracting or other suitable spring or device, l^3, which, when free to do so, tilts or draws the upper or one part of the shoe H away from its brake-wheel i^2 in advance of its lower or other part, as shown in Fig. 1; or I construct the shoe in two parts, H′ and H^2, as indicated in Fig. 3. The braking-surface of the former retreats in advance of that of the latter, it being held in braking-contact by the spring H^3, and its limit of motion is fixed by means of a stud or collar H^4 on its stem H^5.

The operation of the shoe H, (shown in Fig. 1,) is a follows: When the motor is not giving

off its power, the spring L′ maintains the entire braking-surface of shoe H in contact with wheel i^2, to stop the unwinding of the springs C; but when lever L is moved either by hand or foot pressure to modify the force of the brake or move shoe H to and from wheel i^2, the spring l^3 is then free to act, and exerts its power to tilt or withdraw the upper part of said shoe out of brake-contact, and thereby reduces or graduates the extent of its frictional or braking surface whenever the force of the brake or its actuating-spring is decreased or varied to modify the speed of the motor. Such construction and operation provides a variable or graduated surface-brake, the friction of which is modified as the speed of the motor is varied, thereby avoiding waste of motor power, and affording an easy and regular modification of brake force whenever desired; and as the parts of the brake cannot adhere together, the unwinding of the springs may be varied in degree without producing any irregular motion in the working parts of the driven machine.

The operation of the shoe represented in Fig. 3 is substantially the same as that above described, except that the spring H^3 acts expansively to keep the part H^2 in contact with wheel i^2 when part H′ is being withdrawn therefrom as the power of the brake is modified.

To make the brake-shoe self-oiling I groove or kerf its braking-surface longitudinally, transversely, or diagonally, and pack plumbago h' or other similar material in these grooves. The plumbago affords the necessary lubricant for the contact-surfaces of the brake, and they need no further oiling. The end m of push rod M is loosely sustained in an opening, l^4, in lever L, or is otherwise swiveled on the latter, so that a rotary motion may be given to it when it is pushed downwardly to depress lever L. Said rod passes through an opening, k, in a cap or cover, K, as also does the belt or band for wheel i^2, the openings for the latter being shown at k'. Cap K has a depending slotted flange or wall, k^2, and is supported upon the top plate, a^2, to form a shield or casing for preventing access of dirt or other foreign matter to the winding and transmitting devices of the motor. The slots in said cap are provided for the exit or projection of lever L, and the winding end E′ of shaft E, as illustrated in Fig. 1. Said cap may have separable component parts, as indicated in Fig. 1; or they may all be cast or formed integral, as shown in Fig. 6.

Surrounding the rod M and secured to cap K is a segmental, circular, or other appropriate shaped block, m', having a roughened, smooth, notched, or stepped inclined surface or edge, m^2, preferably the latter, as shown in Figs. 1 and 2.

Upon rod M, in line with and adjacent to block or cam m', is a laterally-projecting stud or pin, m^3, which abuts against one of the steps of the incline m^2 whenever the rod M is manually depressed, and rotated to depress lever L to vary the brake force and the speed of the motor. The reaction of the spring L′ holds pin m^3 in engagement with the last step it impinged against during such rotation, and causes it to lock lever L in its adjusted or depressed position to effect a desired constant brake force and a regular speed or power for the motor to transmit to the driven machine for an interval of time, as desired, within the capacity of the motor without requiring constant or continuous application of hand or foot pressure to lever L, whereby the divided attention heretofore demanded of the operator in running the motor and the driven machine is avoided. By reversing the rotation of the rod M, the locking position of its stud or pin m^3 is released or varied.

The push-rod M may alone be used for moving brake-lever L; but I prefer to employ both rod M and stirrup L^2 to afford relief to the operator, and also to permit the application of foot-power to lever L whenever both hands of the operator are engaged in manipulating the work operated upon by the driven machine.

I have shown the rod M and means for locking it and lever L in varying positions within the limit of their motion, applied to a brake-shoe having a graduated or varying brake-surface; but I do not confine myself thereto, as it is evident that said rod and locking appurtenances may be applied to other forms of brakes.

The wheel f and shaft E not only serve as driving or transmitting mechanism for the motor, but also for its winding-gear, as fully explained in aforesaid patent.

To prevent overwinding and setting of springs C C, I provide the motor with either a visual or an audible signal, or both combined. These signals are respectively shown at N and O, Fig. 6. The visual signal N is composed of an upright bar, n, threaded at n'. Upon the latter screws a wheel, n^3, supported between lugs n^2 of a bracket, N′, secured to or cast on plate a^2. Said lugs have openings n^{14} for passage of rod n, and its upper end enters an opening k^3 in cap K.

The wheel n^3 is a star or sprocket wheel, as shown, and as it is rotated in reverse directions it causes the rod n to move up and down in its bearings. To rotate said wheel it is arranged in line with a stud, d', cast or formed on wheel d, so that as the latter rotates it carries with it the stud d', the end of which strikes the teeth of wheel n^3 and revolves it one tooth or more, as desired, during each revolution of wheel d, to produce a slow ascent or descent of rod n. The winding of the springs produces an ascent of rod n, which is continued until its top edge is flush with the upper surface of the cap K. The rod n is so proportioned, and the pitch of its threads n' so regulated, that when the above-described position of rod n is attained it denotes that the springs have been sufficiently wound, whereupon the winding operation is completed. As the springs unwind and the wheel d is reversely rotated, its

stud or lug d' moves wheel n^3 in an opposite direction, to produce a descent of rod n.

To make the signaling position of rod n more striking its top edge is painted or otherwise operated upon to cause it to strongly contrast in color with that of the surface of cap K.

To avoid depending alone upon the eye for preventing overwinding, I prefer to combine with the visual signal a bell or alarm, O, which is secured to cap K, as is also its striker-arm o. The latter is provided with a pivoted spring-supported end piece, o', which yields to downward pressure, while an upward pressure moves it and the striker-arm o. The end o' of the latter is in line with one or more lugs, n^4, on rod n; or recesses or notches may be substituted therefor. As the rod n moves up and down, one of its lugs n^4 strikes the end o' of arm o. Upon the upward movement of the rod, end o' and arm o are both moved, and when released from said lug by its passage by the end o' the striker-arm o falls by gravity and sounds the alarm. This takes place simultaneously with the end movement of rod n, or that which places it in its signaling position, or flush with the top of cap K. Upon the descent of rod n its lug n^4 passes by end o', by reason of the latter yielding to the downward pressure of said lug, and the alarm is not then sounded.

The mandrel (see Figs. 6 and 10) is shown composed of three solid sections, D′, D^2, and D^3, having small bore or central oil-passage, D^4, tapering conical-shaped recesses D^5 in one or both ends, and shoulders D^6 for bearings or supports for the cages B. In the last or mandrel section, D^3, the central oil-passage may be dispensed with; and, if desired, more than three mandrels may be used. The top mandrel-section, D′, is firmly keyed or otherwise secured to wheel d, and has transverse oil-passages d^3 from its central bore to the oil-well of wheel d. Said section has a bearing in the top plate, a^2. The end section, D^3, is formed on or secured to the bottom plate, a, of frame, and the middle section, D^2, is supported upon section D^3, and supports section D′ by means of rounded end or other suitably-configured pins or supports, D^6, bearing upon loose collars or disks D^7 within the recesses D. If desired, these collars may have central oil-ducts, as shown. The pins D^6 are of less diameter than that of the recesses D, to prevent contact with the walls of the latter, thereby reducing the frictional surface between said parts.

The mandrel and cage bearings are lubricated as follows: Part of the oil supplied to wheel d finds its way through aperture d^2 in said wheel to the top-plate bearing for section D′, and thence down the outside of the mandrel to the cage-bearings. Another part of such oil passes through ducts d^3 to the central oil-passage, D, and lubricates the bearings of the pins or supports D. The drip from the mandrel falls onto the upper side of bottom plate, a^5, which has an annular flange, a^6, for confining and collecting such waste oil until it can be removed therefrom.

To prevent the inner end of the springs disengaging from or drawing out of the mandrel-slot as the springs expand, I make said end **S** shape, and provide a correspondingly-configured slot in the mandrel, as plainly shown in Figs. 7 and 8. Such inner end connection of the spring with the mandrel provides a tangential hook or engagement for locking said parts together, and as the strain on said hook or engagement is then in the direction of the length of the spring, its end is not as liable to disengage itself from the mandrel as is the case when said end is radially connected to the mandrel. The opposite or outside end of the springs is secured to the cage as shown, or in any other suitable or desired manner.

To make a cheap, effective, and durable spring, I use ribbons or plates of crucible cast-steel, which are highly carbonized, or carbonized to such extent that they are brittle and liable to break when coiled. The springs coiled therefrom possess great elasticity and durability, due to the high degree of carbonization of the same. To coil these plates without breaking them and without reducing their degree of carbonization, each successive part of the plate is heated before being coiled, and when coiled into a spring it needs no further reheating or tempering. This method of coiling is indicated in Fig. 9, wherein P is the coiling-mandrel, P′ the ribbon or plate of highly-carbonized steel, P^2 the gas or heating medium located to heat the steel or its successive parts before they coil or bend, and P^3 the water, steam, or air jet for cooling said parts immediately after coiling.

I do not herein claim the above-described process or method of making and coiling said springs, as I reserve the same for the subject of a future application for patent.

As the plate is coiled its coils are separated to obtain motion for the spring by means of a layer or a belt of asbestus, which is coiled along with the plate. The asbestus is used because it is fire-proof and is not destroyed by the adjacent hot parts of the plate during coiling. The motor is supported upon rollers or casters R to make it portable, so that when its belt or other like connection is used the motor can be moved in proximity to or placed at a distance from the driven machine. This avoids the necessity of adapting one of said machines to the other.

Any or all of the multiplying-wheels, as well as the other gearing, if desired, are formed with openings s, in which is packed rubber or other elastic material, as more plainly shown in Fig. 6, for the purpose of absorbing or neutralizing the noise produced by their rotation, and thereby provide noiselessly-operating gear for the motor. If desired, the power of the motor may be transmitted to the driven machine by means of a gear-wheel, this being substituted for the belt or crank-rod connection.

I have shown and described the inner end

of the springs made S shape; but it is obvious that the upper part of the S can be a curve, or made angular or otherwise suitably configured, to accomplish the result described. So, too, it is evident that the foregoing described improvements, or any of them, may be applied to other forms of motors than that herein recited and shown.

I have shown the bracket G secured to or supported by a single stanchion, *g;* but it will in practice have a stanchion or support at each end, or be otherwise held in position, as desired.

The springs of the motor are made of different capacity or temper by carbonizing some of the steel plates more than others, and tempering them differently during the coiling operation. This can readily be effected by changing the temperature of the cooling medium employed for different plates.

What I claim is—

1. In a spring-motor having horizontal shaft E with wheel e', the bracket G, having a train of wheels, I, and horizontally located adjoining said shaft, substantially as and for the purpose set forth.

2. A spring-motor having a winding and driving shaft, E, and a bracket, G, having multiplying-wheels I, and arranged at right angles to and above said shaft, substantially as shown and described.

3. In a spring-motor, a top frame-plate, a^2, having bearings for shaft E, and supports *g* for bracket G, having wheels I, substantially as shown and described.

4. In a spring-motor, the bracket G, having train of multiplying-wheels I, the end shaft of which is provided with driving or transmitting mechanism, substantially as shown and described.

5. In a spring-motor, the bracket G, having a train of wheels, I, the end wheel, i^2, of which is adapted to transmit the power of the motor and serve as a brake-wheel, substantially as shown and described.

6. A spring-motor having an end or last transmitting wheel or gear, which forms part of the brake for the motor, substantially as shown and described.

7. A spring-motor provided with a graduated-surface brake, substantially as and for the purpose set forth.

8. A spring-motor provided with a brake-shoe, and means for varying or graduating its surface-contact, substantially as and for the purpose set forth.

9. A spring-motor having a brake-shoe which is normally in engagement or braking-contact, and mechanism attached to said shoe to vary or graduate the extent of its braking-surface, substantially as shown and described.

10. A spring-motor having a brake-shoe, actuating-spring and lever therefor, and means for graduating the surface of frictional contact of said shoe, substantially as shown and described.

11. A spring-motor having a self-lubricating brake-shoe, substantially as set forth.

12. A spring-motor having a brake-shoe packed with plumbago or other lubricant, substantially as and for the purpose set forth.

13. In a spring-motor, the combination of wheel i^2 and brake-shoe H, having retracting-spring l^3, lever L, spring L′, and mechanism for moving said lever, as and for the purpose set forth.

14. A spring-motor having a brake-shoe, with operating-lever and means for automatically locking said lever in its adjusted position, substantially as and for the purpose set forth.

15. A spring-motor having a brake which is adapted to be released by hand or foot pressure, substantially as shown and described.

16. A spring-motor having a brake-shoe and lever provided with a sliding or rotating push-rod, substantially as and for the purpose set forth.

17. In a spring-motor, the combination, with a brake-lever, of a push-rod having mechanism for locking it and said lever in varying positions, substantially as and for the purpose set forth.

18. In a spring-motor, the combination of brake-lever L, spring L′, and push-rod M, having pin m^3 and inclined surface m^2, substantially as shown and described.

19. A spring-motor winding mechanism having a visual signal, substantially as shown and described.

20. A spring-motor having its winding mechanism in gear with a visual or audible signal, substantially as and for the purpose set forth.

21. In a spring-motor, the combination of wheel *d*, having lug *d′*, the wheel n^3, rod *n*, and bracket N′, substantially as and for the purpose set forth.

22. In a spring-motor, the combination of wheel *d*, having lug *d′*, the wheel n^3, rod *n* with lugs n^4, bracket N′, and alarm O, substantially as and for the purpose set forth.

23. A spring-motor having sectional mandrels with recessed ends and separable supporting-pins D^6, substantially as and for the purpose set forth.

24. A spring-motor having sectional mandrels with recesses D^5 in their ends, oil-ducts D^4, washers D^7, and rounded-end pins or supports D^6, substantially as shown and described.

25. A spring for motors having an S-shaped inner end, substantially as shown and described, for effecting a tangential engagement with the mandrel of the motor, as set forth.

26. In a spring-motor, the combination of mandrel D, having a tangentially-arranged S-shaped vertical slot, and springs C, having correspondingly-shaped inner ends, substantially as and for the purpose set forth.

27. In a spring-motor, a mandrel having tangentially-arranged irregular slots, and springs having inner ends shaped to conform to the mandrel-slots, substantially as shown and described.

28. A spring-motor provided with springs of different grade of temper, substantially as described.

29. In coiling motor-springs, the combination of the coiled metal spring with a handle of asbestus, as and for the purpose set forth.

30. A spring-motor having a casing for its springs and a cap or cover for its winding and driving-gear, substantially as shown and described.

31. In combination with a spring-motor, the detachable cap K, as and for the purpose set forth.

32. In a spring-motor, the combination of cylindrical frame *a*, having a top plate, a^2, with case or cover K, and bottom plate, a^5, having rollers or casters R, substantially as shown, and for the purpose set forth.

33. A spring-motor having gear-wheels the webs of which have perforations *s*, filled with a packing of rubber or elastic material, substantially as shown and described.

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

GEORGE F. GODLEY.

Witnesses:
S. J. VAN STAVOREN,
CHAS. F. VAN HORN.