(No Model.) 2 Sheets—Sheet 1.

E. E. BUTLER.

SPRING MOTOR.

No. 537,670. Patented Apr. 16, 1895.

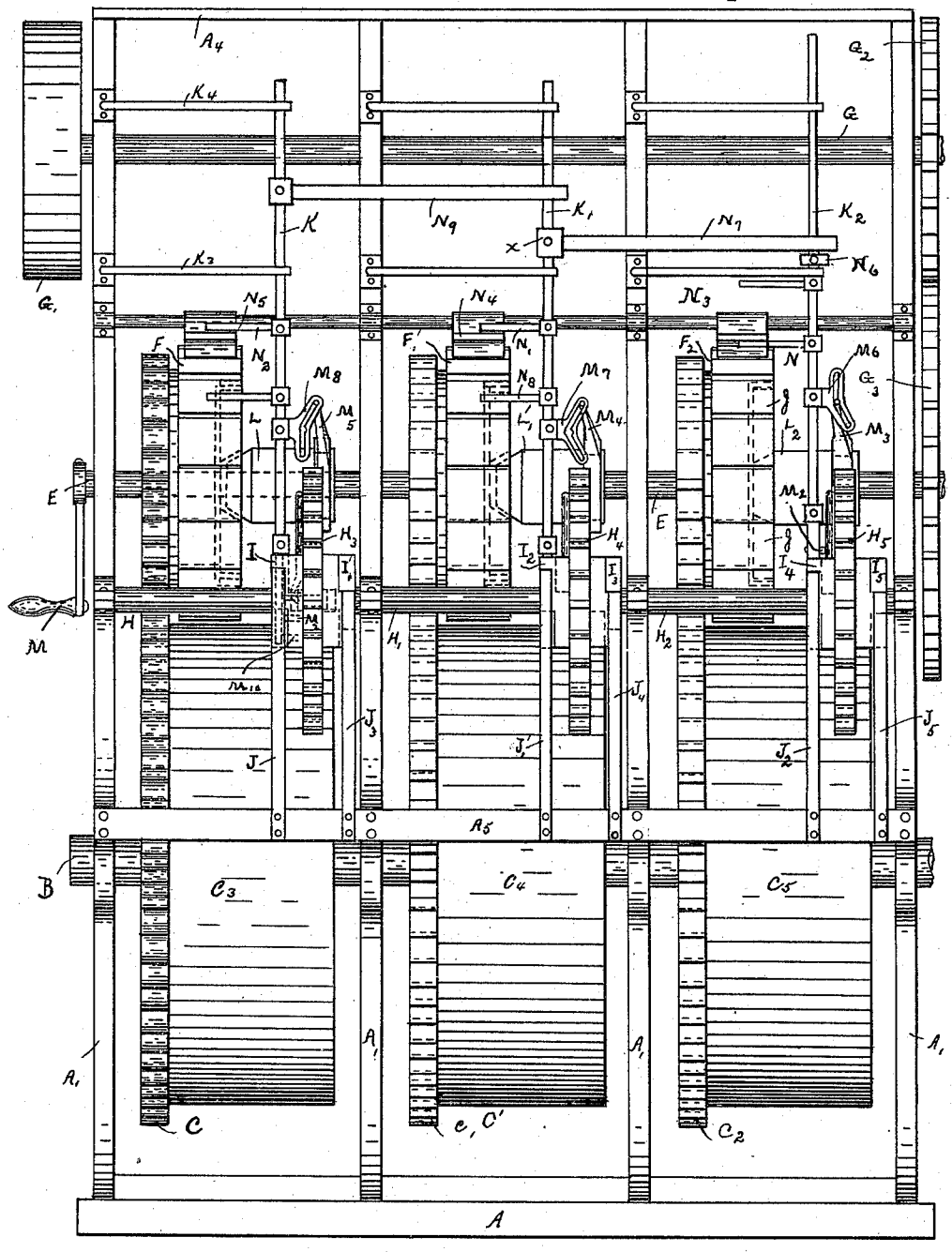

Fig. 1.

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S. H. Cole

Inventor,
Edward E. Butler.

By His Attorney,
J. B. Moore.

(No Model.) 2 Sheets—Sheet 2.

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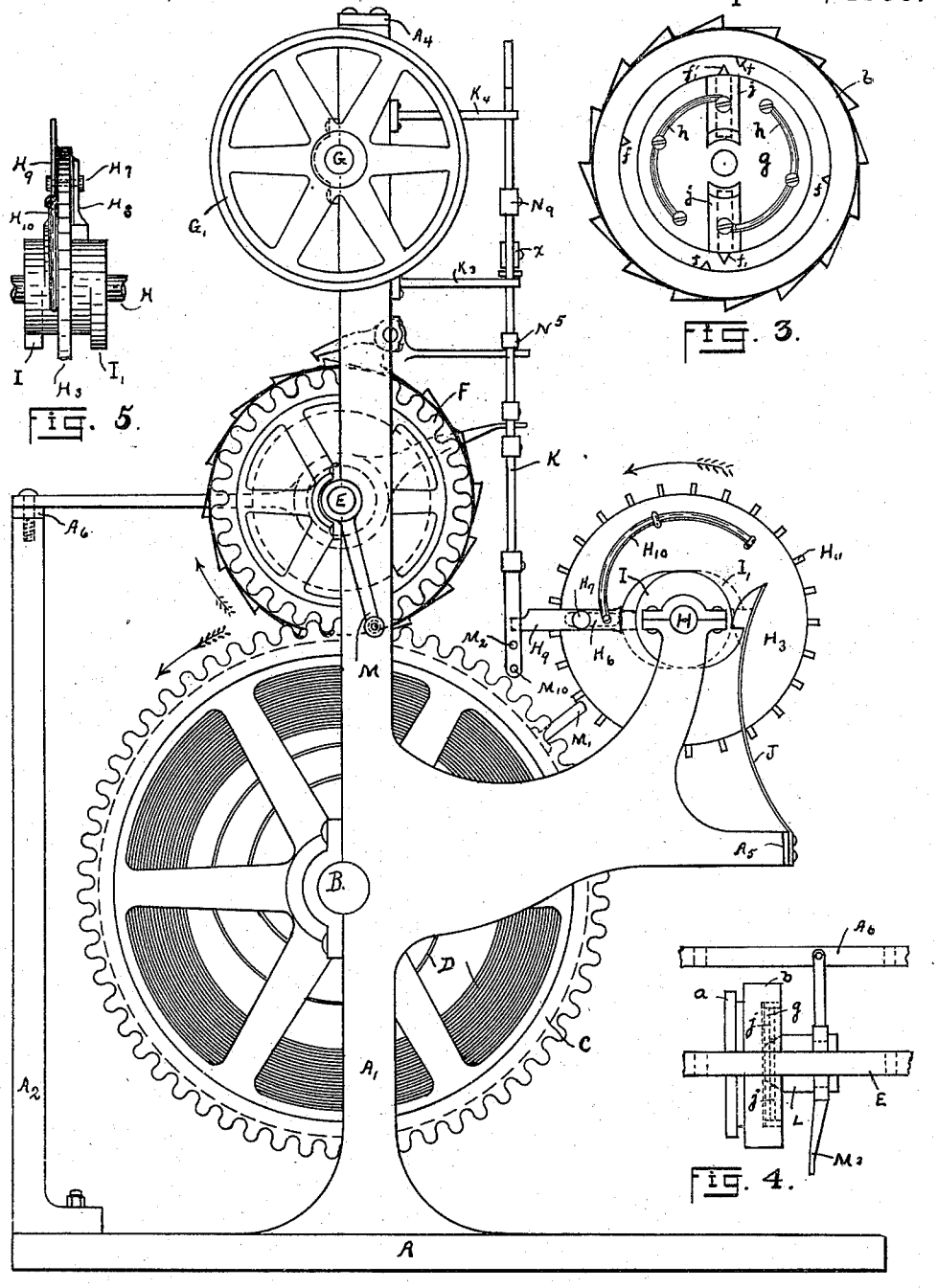

FIG. 2

FIG. 5.

FIG. 3.

FIG. 4.

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C. E. Ard.
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UNITED STATES PATENT OFFICE.

EDWARD E. BUTLER, OF ATLANTA, GEORGIA, ASSIGNOR OF TWO-THIRDS TO ROBERT P. HORTON, OF SAME PLACE.

SPRING-MOTOR.

SPECIFICATION forming part of Letters Patent No. 537,670, dated April 16, 1895.

Application filed July 28, 1894. Serial No. 518,902. (No model.)

To all whom it may concern:

Be it known that I, EDWARD E. BUTLER, a citizen of the United States, residing at Atlanta, in the county of Fulton, State of Georgia, have invented a new and useful Spring-Motor, of which the following is a specification.

The object of my invention is to provide an efficient spring motor that will continue to run any required length of time, it simply being a matter of how many springs compose the motor, it being understood that any spring after having done its work will automatically put its adjoining spring into action and thus throughout the entire series. I attain this object by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a front side elevation of my machine; Fig. 2, an end elevation. Fig. 3 is a detail of ratchet and small gear showing the mechanism as used to cause it to move with its shaft and releasing same when desired. Fig. 4 is a detail of the cone shaped cam and connecting parts, and shows the manner in which it operates on the spring clutch jaws shown in Fig. 3. Fig. 5 is a detail showing the arrangement of the eccentric cams in relation to the toothed wheel G^3.

Similar letters refer to similar parts throughout the several views.

The rectangular piece A and uprights A′ and A^2 and tie pieces A^4, A^5 and A^6 constitute the framework of my machine.

A stationary shaft B is fastened to the frame and on this shaft, at regular intervals are a number of loose gears C C′ C^2, three being shown on this machine, but there can be any number of these gears according to the length of time it is desired that the motor should run. To the gears C C′ C^2 there are fastened drums C^3 C^4 C^5 each of which contains a flat coiled spring D, one end of the spring being fastened to shaft B and the other end to the drum. Directly above the shaft B is a revoluble shaft E supported by boxes bolted to the uprights A′. Loosely mounted on shaft E are combination gear and ratchet wheels F F′ F^2. Referring to Figs. 3 and 4 the construction of this combination wheel is as follows: Upon the rim *a* are gear teeth, and ratchet teeth are cut on the rim *b*. The part upon which the ratchet teeth are cut is counterbored to the depth and diameter shown by the outside dotted lines Fig. 4, a number of projections *f* Fig. 3 being left to engage with the projection *f′*. There is fastened to the shaft E a plate *g* fitting in the counterbore of the ratchet wheel and to this plate are fastened the springs *h* each of which in turn has the sliding clutch jaws *j* fastened to them. The projections *f* and *f′* are to be so made that they will pass each other when the jaws *j* are normally held by the springs *h*.

The revoluble shaft G is secured to the frame in the same manner as is the shaft E. To the shaft G is fastened a pulley G′ and pinion G^2 Fig. 1. The pinion G^2 meshes with the gear G^3 which is secured to the shaft E.

There are three shafts H H′ H^2, supported by the upright A′ having their centers all in the same plane. To each of these shafts a wheel H^3 H^4 H^5 is secured. Referring to Figs. 2 and 5 the construction of this wheel is as follows: A slot H^6 is made through the wheel. A bolt H^7 passes through this slot and connects the piece or jaw H^8 to H^9 that they are held rigidly one to the other, but not held to the wheel H^3. The piece H^9 is secured to a spring H^{10}, the normal position of the spring being toward the shaft H. The wheel H^3 has a number of teeth H^{11} at regular intervals on its circumference it being necessary as will be shown hereinafter, that the number of teeth on the wheel H^3 shall be equal to the number of revolutions that the drums C^3 C^4 C^5 will make to completely wind the spring D around shaft B. A peg M′ is fixed on the rim of each drum such that at each revolution of the drum it will contact with a tooth on the wheel H^3 and drive it through a portion of a revolution equal to the pitch of the teeth H^{11}. It will thus be seen that when the drum has gone through the number of revolutions required to completely wind the spring, the wheel H^3, will have moved through one revolution. On each side of the wheels H^3, H^4 and H^5 respectively and loosely on the shaft H, are cams I, I′, I^2, I^3, I^4, I^5. All of these cams are made from the same pattern, but each one of a pair as I, I′ Fig. 5 is placed on the shaft opposite the other which has the effect of making them right and left handed. The flat

springs J J′ J² are so constructed that the lug on each of them will act as a stop for the lugs on the cams I, I², I⁴ respectively and the lugs on springs J³ J⁴ J⁵ are turned one hundred and eighty degrees from those on springs J J′ J² to act as a stop for the lugs on cams I′ I³ I⁵. The perpendicular rods K, K′, K², are free to move up or down in the bearings K³, K⁴.

The eccentric cams I, I³, I⁵, actuate the jaws H⁸, H⁹ when the springs are being wound and the cams I, I², I⁴ are for the same purpose when the springs are running down.

The operation of my machine is as follows: The parts of the machine are shown just as the winding of the springs begins. The spring in drum C⁵ is first wound. The conical cam L² is in position holding the spring clutch jaws *j* farthest from the center of the wheel F², thereby causing the projections *f* and *f′* to contact one with the other Fig. 3. Now when the cam is in this position, if the shaft E be rotated in direction of arrow by means of the crank M, the plate *g* Fig. 3 which is fast to the shaft will rotate and carry with it the gear and ratchet F² which being in gear with C² will cause it to rotate on the fixed shaft B carrying the drum C⁵ around with it. The spring contained in the drum C⁵ will thus begin to wind around the shaft B. At the beginning of motion the pieces H⁸ and H⁹ will be pulled against that portion of the eccentric cam I⁵ nearest the center of the shaft H by the spring H¹⁰. When the spring is almost wound, the jaw H⁸ will be pushed away from the center of shaft H by that portion of the cam I⁵ farthest from the center. The jaw H⁸ being connected to jaw H⁹, jaw H⁹ will be moved out far enough to catch under the pin M² and the rod K² will be lifted. When the rod K² is moved up, it will cause the end of the cam lever M⁸ to move along the slotted guide M⁶ pulling with it the conical cam L². As the spring jaws *j* Fig. 3 are released by the cam, the springs *b* will pull the projections *f f′* apart and release the gear from plate *g*. At the instant this operation is taking place the arm N strikes the end of the pawl N³ and causes it to catch the ratchet. Thus the gear and ratchet F² are released from the shaft E and the tension of the spring is held by the pawl and ratchet. When the rod K² moves up, the collar N⁶ lifts the arm N⁷, which being rigidly connected to rod K′ raises it an equal amount. As the rod K′ is raised the end of the cam lever M⁴ will move along the slotted guide M⁷ and pull the cam L′ into the spring jaws and secure the gear F′ to the shaft as was the gear F². The spring inclosed in drum C⁴ is now ready to be wound and when this is completed the jaw H⁹ on wheel H⁴ will lift the rod K′ in the same manner as K² was lifted. The cam lever M⁴ will move along the lower part of the slotted guide M⁷ and the cam L′ will be thrown out and the gear released. The arm N⁸ will have moved up and thrown the pawl N⁴ into its ratchet. Coincident with the last named operation the hub of arm N⁷ will have acted on arm N⁹ and thrown the rod, K up, the cam L into action with the spring clutch jaws and secure the gear F to the shaft E as before. The end of the cam lever M⁵ is now in the middle of its travel along the slotted guide M⁸ and when the spring in the drum C³ is completely wound, the rod K will be raised as before and the end of the cam lever M⁵ will now move in the lower part of the slotted lever M⁸ which slot is parallel to the direction of motion. This will instead of throwing the cam L out cause it to remain in the position previously assumed. If the crank M be now released the tension of the spring in drum C³ will rotate the drum and gear C, the motion will be communicated to shaft E, thence through gears G³, G² to shaft G causing it to revolve, carrying with it the pulley G′ from which the power is taken. It is to be observed that the jaw H⁹ has released the pin M² and brought the pin M¹⁰ into position to contact with the jaw H⁹, at the beginning of the reversed motion of the drum C and wheel H³. Now when the jaw H⁹ contacts with the pin H¹⁰ it will push it down carrying with it the rod K, the cam lever M⁸ will slide in the slotted guide parallel to the line of motion of the rod and the cam will remain between the spring jaws. When the spring D has given out its power the wheel H³ will have made a complete revolution in the direction of the arrow. The cam I will now cause the jaw H⁹ to move out and catch the pin M² and push the rod K into its lowest position. The cam L is thrown out and at the same instant the arm N presses the hub *x′* and rod K′, down, throws the cam L, into position to secure the gear F′ to the shaft and the arm N, throws the pawl up and releases the gear and thus through the entire series until all of the springs are unwound.

It is to be observed that the movements of all the parts are just the reverse in running down from what they were when the springs are being wound.

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

1. The combination, in a spring motor, of a shaft B, a drum and gear fixed one to the other, mounted thereon, said drum containing a flat coiled spring, and having a pin M′ fixed to its periphery intermediate connections between said drum and shaft E, the shaft E, the gear and ratchet F² loosely mounted thereon, plate *g* fixed to said shaft and contained in said ratchet, spring clutch jaws *j* secured to plate *g*, means for operating the jaws and securing gear and ratchet F² to shaft E, substantially as herein described.

2. In a spring motor, the combination of a shaft B, a drum containing a flat coiled spring mounted thereon, intermediate connections between said drum and shaft E, the shaft E, the gear and ratchet F² loosely mounted thereon, the plate *g* fixed to shaft E and con-

tained in said ratchet F^2, the spring clutch jaws *j*, the sliding cone shaped cam L^2 for operating the jaws, the slotted cam M^6, and the rod K^2 all of said parts operating substantially as herein described.

3. In a spring motor the combination of a shaft B, a drum containing a flat coiled spring mounted thereon, said drum having a pin M′ fixed to its periphery, a shaft H, the wheel H^5 mounted thereon and having pins upon its periphery with which said pin M′ is adapted to come into contact, and also having the spring pressed pawl or lugs H^8, H^9, the cams I^4, I^5 loosely mounted on said shaft H and adapted to actuate the lugs H^8 H^9, the rod K^2 having the guide M^6, arm N^4, pawl N^3 and cam lever M^3, in the movement of which, said parts are brought into operative action, substantially as herein described.

EDWARD E. BUTLER.

Witnesses:
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A. JESSOP.