(No Model.)

F. SHAW.

SPRING MOTOR.

No. 304,363. Patented Sept. 2, 1884.

Fig. 1.

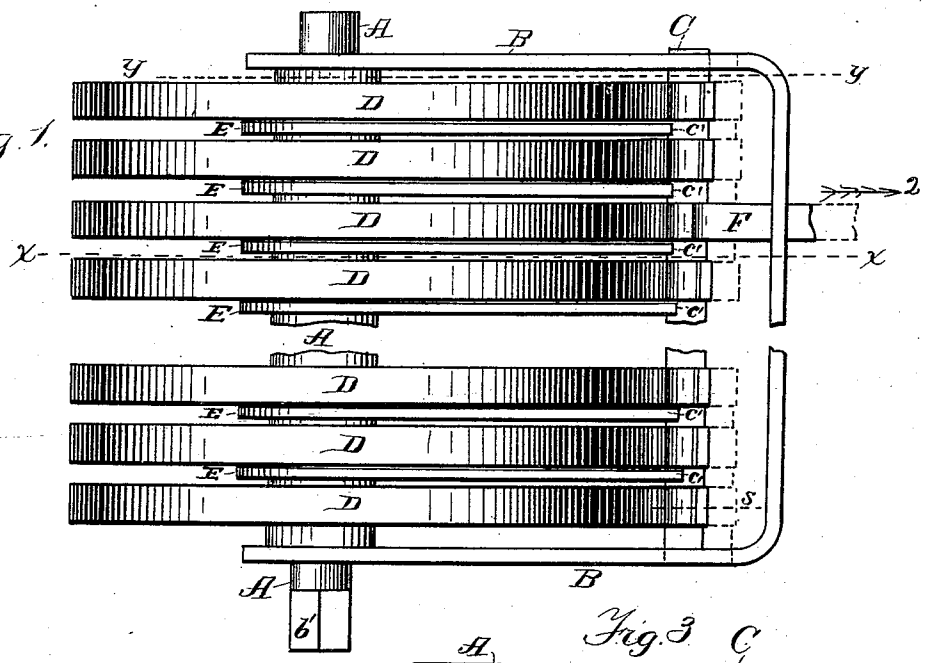

Fig. 3

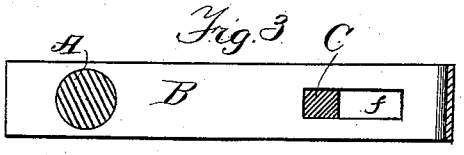

Fig. 2

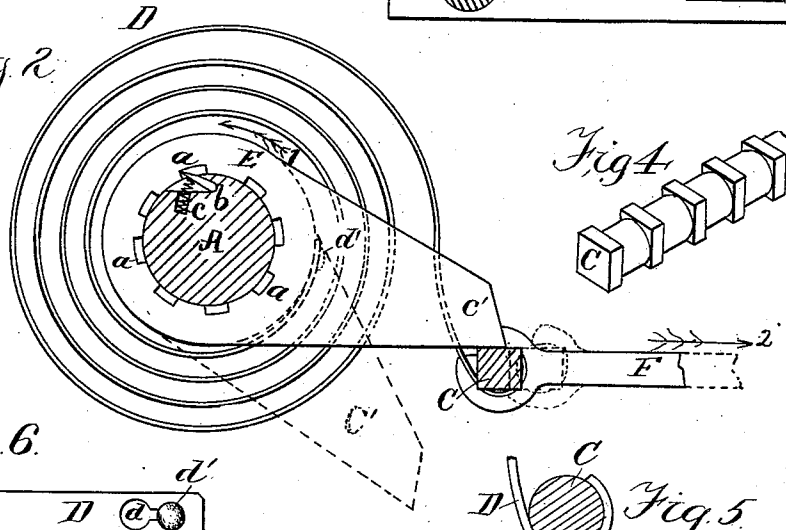

Fig. 4

Fig. 6.

Fig. 5

Witnesses:
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UNITED STATES PATENT OFFICE.

FRANCIS SHAW, OF LYONS, IOWA, ASSIGNOR OF ONE-HALF TO WILLIAM BRIGGS, OF SAME PLACE.

SPRING-MOTOR.

SPECIFICATION forming part of Letters Patent No. 304,363, dated September 2, 1884.

Application filed February 27, 1884. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS SHAW, a citizen of the United States of America, residing at Lyons, in the county of Clinton and State of Iowa, 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.

My invention relates to spring-motors; and it consists of a series of separate springs constructed and arranged so that they may all be wound up in concert, and the force of each spring may be applied separately to produce and transmit continuous motion without the intervention of a train of gearing, as hereinafter fully set forth.

In the drawings, Figure 1 is a plan view of my invention. Fig. 2 is a section taken on line *x x* of Fig. 1. Fig. 3 is a section taken on line *y y* of Fig. 1. Fig. 4 is a perspective view of a portion of the stop-bar detached. Fig. 5 is a section on line *s* of Fig. 1. Fig. 6 is a top view of the inner end of one of the springs.

A designates a driving-shaft, having its bearings in a frame, B, and connected in any suitable manner with the machinery (not shown) to which motion is to be transmitted.

C is an adjustable detent-bar, having its bearings in slots *f* in the frame B.

D designates a series of coiled springs, the outer ends of which are bent around and held in place by the bar C, and the inner ends of the springs are attached to the hubs E by means of the openings and slots *d* in the ends of the springs to receive the button *d'*, attached to the hubs. These hubs are constructed separate from each other to fit loosely over the shaft A, which is provided with a groove, *d²*, extending the whole length of the shaft to receive the series of pawls *b*, which are held by the springs *c* in position in the groove to catch in notches *a* in the hubs, as seen in Fig. 2. The shaft is provided with a separate pawl for each hub. Each hub has formed on it a detent-arm, *c'*, the required length to reach to and bear against the detent-bar C, the arms being of different lengths, so that each may be released and its force applied separately, as hereinafter set forth.

F is a bar attached to the bar C and connected with devices (not shown) for moving the bar outward to release the ends of the detent-arms *c'*, as indicated by the arrow 2, and by the dotted lines in Fig. 2. The bar C being thus moved outward beyond the reach of all the detent-arms, all of these springs are wound up simultaneously by revolving the shaft with any suitable power and mechanism (not shown) applied to the shaft A—as, for example, a crank-arm on the end *b'*—the pawls *b* catching in the notches *a* of the hubs, and causing them to revolve with the shaft in the direction of the arrow 1 in Fig. 2; and when the springs are thus wound up the bar C is allowed to be moved inward by the contracting force of the springs into position for the ends of all the detent-arms *c'* to rest upon it, as shown. The springs being thus all wound up, the force of each spring is applied separately to the driving-shaft in the following manner: The bar C is moved outward, as described, far enough only to release the shortest one of the arms *c'*, allowing the spring attached to its hub to exert its force upon and revolve the shaft by means of the pawl *b* in one of the notches *a*, the pawls being all constructed and arranged so as to allow the shaft to revolve freely in the remaining hubs. When this spring has expended its force to the extent which may be desirable, the bar C is then moved outward far enough to release the next shortest arm, allowing its spring to exert its force upon the shaft, and so on until all the arms are released and each spring in turn has spent its force in revolving the shaft.

It is evident that a machine may be provided with any desired number of these separate springs, each provided with its independent pawl and detent-arm; and it is also evident that the number of revolutions of the shaft by the springs will depend upon the number of revolutions of the shaft required to wind up the springs and the number of the springs. For example, if it requires the shaft to be revolved twenty times to wind up the springs, and the machine is provided with forty springs, their aggregate force applied separately, as described, will revolve the shaft twenty times forty—that is, eight hundred rev-

olutions—with one winding of the springs, thus continuing and multiplying the motion without the intervention of a train of gearing.

While the groove d^2, pawls *b*, and springs *c* constitute a system of mechanism, they have nothing to do with the winding up of the springs, except that when the shaft A is revolved in the reverse direction (indicated by the arrow 1) each pawl catches in a notch of its hub and revolves the hub and its detent-arm with the shaft.

It is intended to wind up the motor by steam or water power, to be applied by any suitable mechanism. (Not shown.) The ratchet mechanism is constructed and arranged so as to allow the shaft to revolve freely under the momentum of a fly-wheel, or the power of one or more of the springs, without interfering with or being obstructed by the ratchet devices of the remaining springs, the force of which may be arrested for the time, as herein described.

My intention is to employ a governor and a balance-wheel, to be connected with the motor by suitable mechanism, for regulating the force of the springs and the movements of the driving-shaft. One great obstacle in the way of the application of spring-motors to street-cars has been the cost and weight of a frame of sufficient strength to stand the strain produced by the springs and gearing. I claim that I avoid this difficulty by attaching the outer ends of the springs to the adjustable bar, upon which the detent-arms have their bearing after the springs are wound up, and until they are released. The downward pressure of the detent-arms serves to balance, to a large extent, the upward strain caused by the springs.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a spring-motor, the driving-shaft A, having a longitudinal slot adapted to receive a series of independent pawls, and provided with seats for springs adapted to hold the pawls in place in the slot, substantially as and for the purpose described.

2. The combination, in a spring-motor, with the driving-shaft A, provided with a series of independent pawls, *b*, of a series of independent driving-springs, D, each spring having its outer end attached to an adjustable bar, and its inner end attached to an independent hub placed loosely over the shaft, and having a detent-arm extended in position to be arrested against the adjustable bar, and thus balance the strain produced by the spring upon the frame, substantially as and for the purpose described.

3. A spring-motor provided with a series of detent-arms of varying lengths, each arm being connected with a separate driving-spring and arranged to be released separately, substantially as and for the purposes described.

4. In a spring-motor, the combination of the driving-shaft A, provided with pawls *b*, the adjustable stop-bar C, the series of coil-springs D, the hubs E, provided with notches *a*, and the detent-arms *c'*, of different lengths, substantially as and for the purposes described.

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

FRANCIS SHAW.

Witnesses:
W. W. SANBORN,
I. R. ANDREWS.