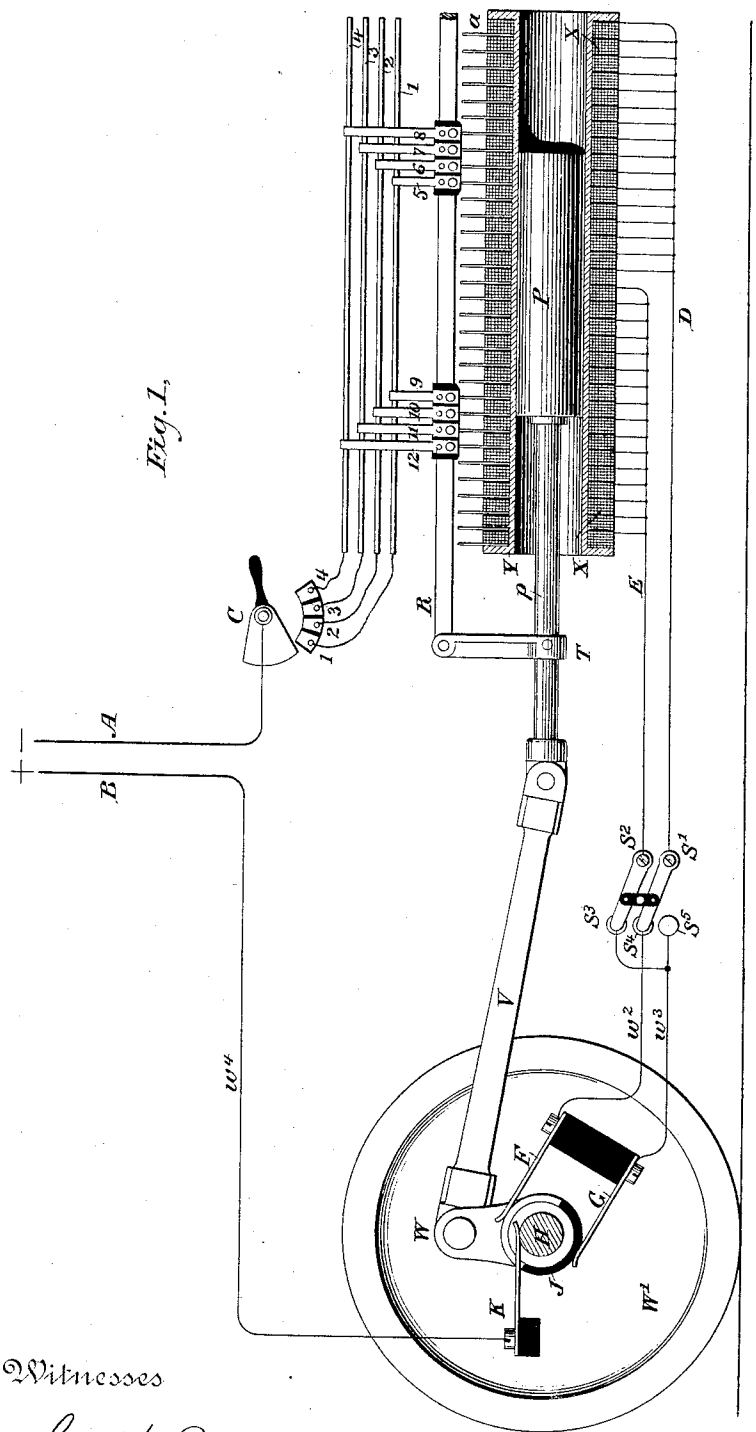
(No Model.)

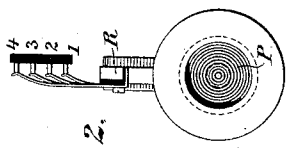
3 Sheets—Sheet 1.

M. G. FARMER.

ELECTRO MAGNETIC MOTOR.

No. 323,652. Patented Aug. 4, 1885.





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(No Model.)

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Fig. 3.

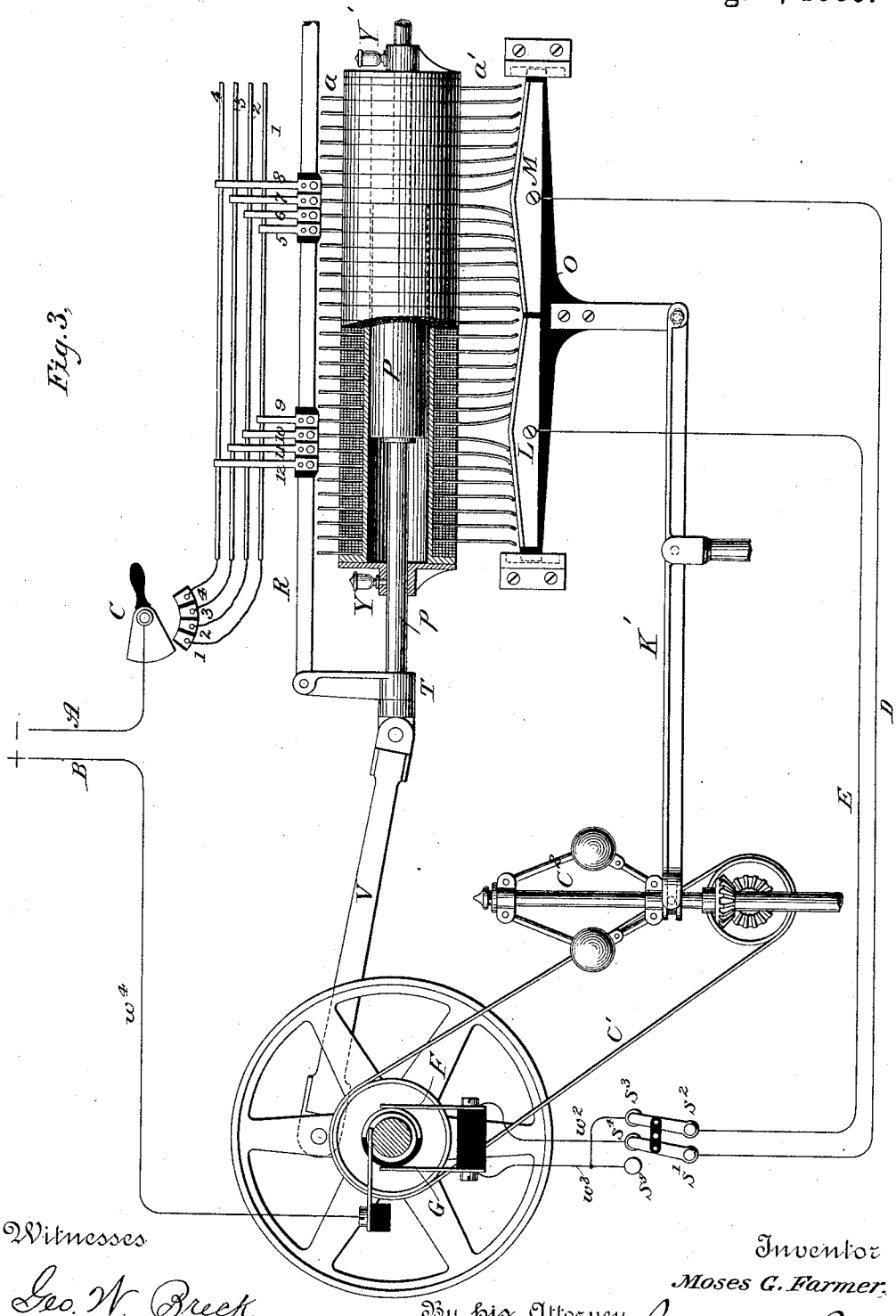

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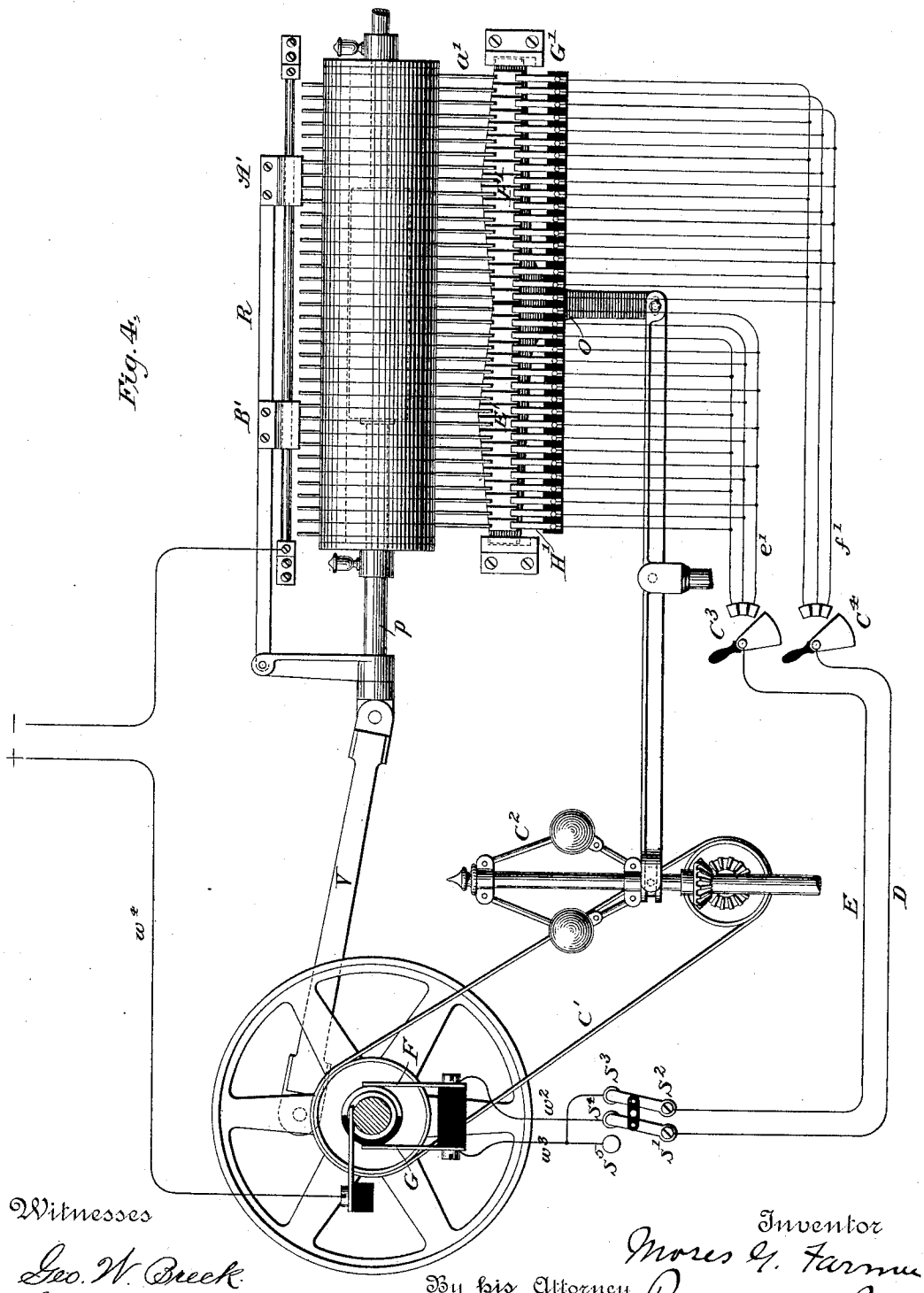
Fig. 4.



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UNITED STATES PATENT OFFICE.

MOSES G. FARMER, OF NEWPORT, RHODE ISLAND.

ELECTRO-MAGNETIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 323,652, dated August 4, 1885.

Application filed March 27, 1885. (No model.)

To all whom it may concern:

Be it known that I, MOSES G. FARMER, a citizen of the United States, and a resident of Newport, in the county of Newport and State of Rhode Island, have invented certain new and useful Improvements in Electro-Magnetic Motors, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

My improvements relate to electro-magnetic motors containing one or more sectional helices in which a core or plunger is arranged to reciprocate. The motor may be stationary or a locomotor, and may be used for and of the many purposes to which steam and other engines are now applied.

The improvements involve certain novel means for directing the current through the proper sections of the helix or helices to produce the reciprocation of the core or plunger; secondly, devices for reversing the action or movement of the motor; thirdly, means for regulating the power developed by the motor; and, lastly, certain new and useful details in the construction of the motor that render the same more efficient and practicable.

I will describe the construction of the motor by reference to the accompanying drawings, and indicate more fully hereinafter the special features which form the subject of my invention.

Figure 1 is a side elevation and part section of a motor embodying a portion of my improvements. Fig. 2 is a cross-section through the helix. Fig. 3 is a view similar to Fig. 1 of the motor with my improved regulating devices combined therewith. Fig. 4 is a side elevation of the operative parts of the motor somewhat modified in details.

Referring to Fig. 1, Y designates a flanged cylinder of non-magnetic metal that forms a spool or receiver for the helix, which is composed of a number of sections, X—in this case thirty-two in number. The cylinder Y forms a way for the reciprocating core or plunger P, of soft iron.

To the plunger P is connected the rod *p*, which is joined by the connecting-rod V with the crank W of a fly-wheel, W′.

One end of each section of helix X is connected to a spring plate or brush, *a*. These plates are all of the same length and lie in the same line, being suitably secured between the several sections, as shown. The other ends or terminals of the sections X are joined in two groups and connected to the wires E D.

An arm, T, is secured to the piston-rod *p* at right angles, and is connected to a bar, R, arranged to slide above the row of spring-contacts *a*. This bar R carries two sets of insulated metal plates, having spring-fingers of different lengths, numbered from 5 to 12. A series of metal bars or strips, 1 2 3 4, are secured to a suitable support, and so arranged that two of the fingers, 5 to 12, remain always in contact with each strip or bar during the movement of the plunger. The strips 1 2 3 4 are connected with the insulated contacts of a switch, the said contacts being numbered to correspond with their respective bars or strips. The pivoted lever C for this switch carries a metal plate of sufficient width to cover all of the contacts at the same time.

Wires D E connect to the parallel levers S′ S^2 of a reversing-switch, which is provided with three contacts, S^3 S^4 S^5. The contacts S^3 and S^5 are electrically connected to a wire, w^3, that leads to a spring plate or brush, G, carried by an insulating-holder. A wire, w^2, connects contact S^4 with another and similar brush, F, on said holder.

The brushes F G bear on the surface of a cylinder carried or revolved by the axle of the wheel W′. One half of this cylinder is covered by an insulated metal plate, J. The other half is of insulating material. The plate J is electrically connected with the axle, or a metal cylinder, H, carried thereby. Upon this cylinder H bears a brush, K.

The terminals of the motor are represented by the letters A B. The former is connected with the plate of switch C, the latter by wire w^4 with the brush K.

The mode of operation of the apparatus is this: When connected with the battery, the switch C, turned into contact with all of the plates 1 2 3 4, and the switch-levers S′ S^2 in the position shown, the current flows through wire w^4, brush K, plate J, brush G, wires w^3 and E, to the sections of the helix at the for-

ward end of the same. It will pass through the four sections of helix, the spring-terminals *a* of which are in contact with the metal plates and fingers 9 10 11 12. The force exerted by these coils draws the plunger P forward; but as the movement of the plunger carries forward the bar R the fingers 9 10 11 12 slide over the spring-contacts *a* and keep only the coils ahead of the plunger active. The movement of the plunger turns also the commutator, so that at the proper moment the insulating half comes under the strip or brush G, and the metal portion under brush F. This directs the current through wire D and those sections of helix that are brought into circuit by the fingers 5 6 7 8, and the plunger is consequently drawn backward. The further movement of the motor is produced by repetitions of these actions.

The function of the switch C will now be understood. When it connects with all four contacts, 1 2 3 4, four coils or sections are connected in multiple arc with the circuit in front of the plunger, and the full force of the current exerted. To use less of the current and reduce the amount of power, the switch is turned to bring three, two, or only one of the bars 1 2 3 4 into connection with the circuit.

To reverse the motion of the motor the switch-levers S^2 S′ are shifted onto the contacts S^4 S^5, whereby the current is transferred to the sections of helix at the opposite end of the plunger, as will be readily understood.

In order to provide for the automatic regulation of the motor I have devised the mechanism shown in Fig. 3. This consists of the following devices: A centrifugal governor, C^2, of any kind is driven by a belt, C′, from the main shaft. The governor operates a pivoted bar, K′, that carries an insulating cross-piece, O. To this piece are connected the metal contact-plates L M, each formed with a smooth surface highest at the middle point. Both ends of each section of helix in this case are provided with spring-contacts, those designated by the letter *a* being the same as in the former case. The other springs, *a′*, are somewhat longer, however, and are arranged to bear upon the contact-plates L M. When the motor is at rest, the plates L M are in their most elevated position, and all of the strips *a′* are in contact therewith. On starting up the motor, if the load is too small for the current used, the tendency is to speed up. This is checked, however, by the governor C, which lowers the plates L M more or less, and thus severs the connection with one or more of the strips *a′* at each end of the two plates. The current, when not applied at the ends of the stroke, has not the same effect in propelling the motor, so that the increase in speed is prevented, as the core has a stroke of uniform length, from which a portion of motive power will be cut off, or to which a portion will be added, as the case may be. It will be readily seen that the higher the speed at which the motor tends to run the more strips *a′* will be disconnected. In this figure the remaining parts of the motor are the same as in Fig. 1, and guides Y′ are shown at each end of the helix for the piston-rod *p*.

In Fig. 4 the motor and regulator are shown in a somewhat modified form. In lieu of using two or more bars, as 1 2 3 4, and sliding contacts for each, I may use two moving or sliding contacts, A′ B′, to which the current is conveyed in any convenient manner, as by the bar upon which they are arranged to slide. These contacts are wide enough to make contact with two or more of the strips at a time, and are carried, as in the other cases, by the bar R, connected with the piston-rod *p*. I employ, also, in this case, a centrifugal governor, C^2, that is arranged to impart a vertical movement to an insulating-bar, O. Bar O carries two series or sets of insulated metal plates, E′ F′, the plates of each set being shortest at the ends, and gradually increasing in length toward the middle of the series. Upon them bear strips or wipers *a′*, connected with the ends of the sections of helix, and arranged to slide vertically over the strips E′ F′.

G′ is a stationary insulating-support below the bar O, and to it are attached a row of contact fingers or strips, H′, corresponding in number and position to the strips E′ F′, and arranged to bear constantly upon the faces of the same.

C^3 C^4 are two switches, each having three insulated contacts, from which lead the wires *e′* and *f′*. The contacts bearing on plates E′ are connected alternately to the wires *e′*, and those bearing on F′ are connected in the same manner to wires *f′*. The action of the centrifugal governor and the regulating devices operated thereby is the same as has been described with reference to Fig. 3. The number of sections rendered active at the same time is determined by the position of the switches C^3 C^4 and the number of contacts which they cover.

I have described but a few of the many modifications which may be made without departure from my invention. I will now state that the number of helices is not limited to one in a single motor, as it is evident that the one shown may be duplicated or triplicated; also, that the number of bars 1 2 3 4, or their equivalents, is in a measure arbitrary, as also is the number of sections in each helix and the parts pertaining thereto.

Having now described the general nature of my invention, and the best manner of which I am aware in which the same is or may be carried into effect, what I claim is—

1. In an electro-magnetic motor, the combination, with a sectional helix composed of separate groups of connected sections, and a reciprocating core, of the following devices or their described equivalents, viz: stationary conducting-bars, and sliding contacts for completing the circuit from the sections of the helix successively, and a rotating commutator

and connections for completing the circuit alternately to the groups of sections of the helix at opposite ends of the core alternately, as and for the purpose set forth.

2. In an eletcro-magnetic motor, the combination, with a sectional helix, and reciprocating core, of the following devices or their described equivalents, viz: stationary conducting-bars, a switch for connecting one or more of said bars to the circuit, sliding contacts for completing the circuit from the sections of the helix to the bars successively, a rotating commutator, and connections for completing the circuit to the sections of the helix at opposite ends of the core alternately, as herein set forth.

3. In an electro-magnetic motor, the combination, with a sectional helix and reciprocating core, of the following devices or their described equivalents, viz: stationary bars, and a switch for connecting one or more of the same in circuit, sliding contacts for completing the circuit from the sections of the helix, a rotary commutator, and connections for completing the circuit to the sections of the helix on opposite sides of the core alternately, and a circuit-shifting switch through which the current to the sections of the helix passes, as and for the purpose set forth.

4. In an electro-magnetic motor, the combination, with a sectional helix, a reciprocating core, and means for completing the circuit from said sections successively, of contact-plates for completing the circuit to the sections of helix and automatically governing devices for altering the position of the same, whereby the circuit to more or less of the sections may be interrupted, as and for the purpose set forth.

5. In an electro-magnetic motor, the combination, with a sectional helix, a reciprocating core having a stroke of uniform length, and means for completing the circuit from said sections successively, of contact-plates for completing the circuit to the sections of helix, and means for altering the position of said contact-plates, whereby the current to more or less of the sections may be interrupted, as and for the purpose set forth.

6. In an electro-magnetic motor, the combination, with a sectional helix, a reciprocating core, and means for completing the circuit from the sections successively, of contact-plates for completing the circuit to the other sections, and a centrifugal governor driven by the motor and adapted to vary the position of the contact-plates, whereby more or less of the sections are disconnected therefrom, substantially as set forth.

7. In an electro-magnetic motor, the combination, with a sectional helix, reciprocating core, and means for completing the circuit from said sections successively, of the following devices or their equivalents, viz: two contact-plates with inclined or beveled surfaces, a centrifugal governor for moving the same out of contact with more or less of the terminals of the sections of the helix, a rotating commutator, and connections to the movable contact-plates, whereby the circuit is completed to more or less of the sections in each half of the helix alternately, as set forth.

8. The combination, with the sectional helix and reciprocating core, of stationary contact-bars, and a switch for connecting one or more in the circuit, the sliding contacts arranged to bear upon said bars and in the path of the free terminals of the sections of the helix, a rotating commutator, one-half of the surface of which is metallic and connected with the circuit, contact-strips bearing on said commutator, and connections from the strips to the sections on opposite halves of the helix, as and for the purpose specified.

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