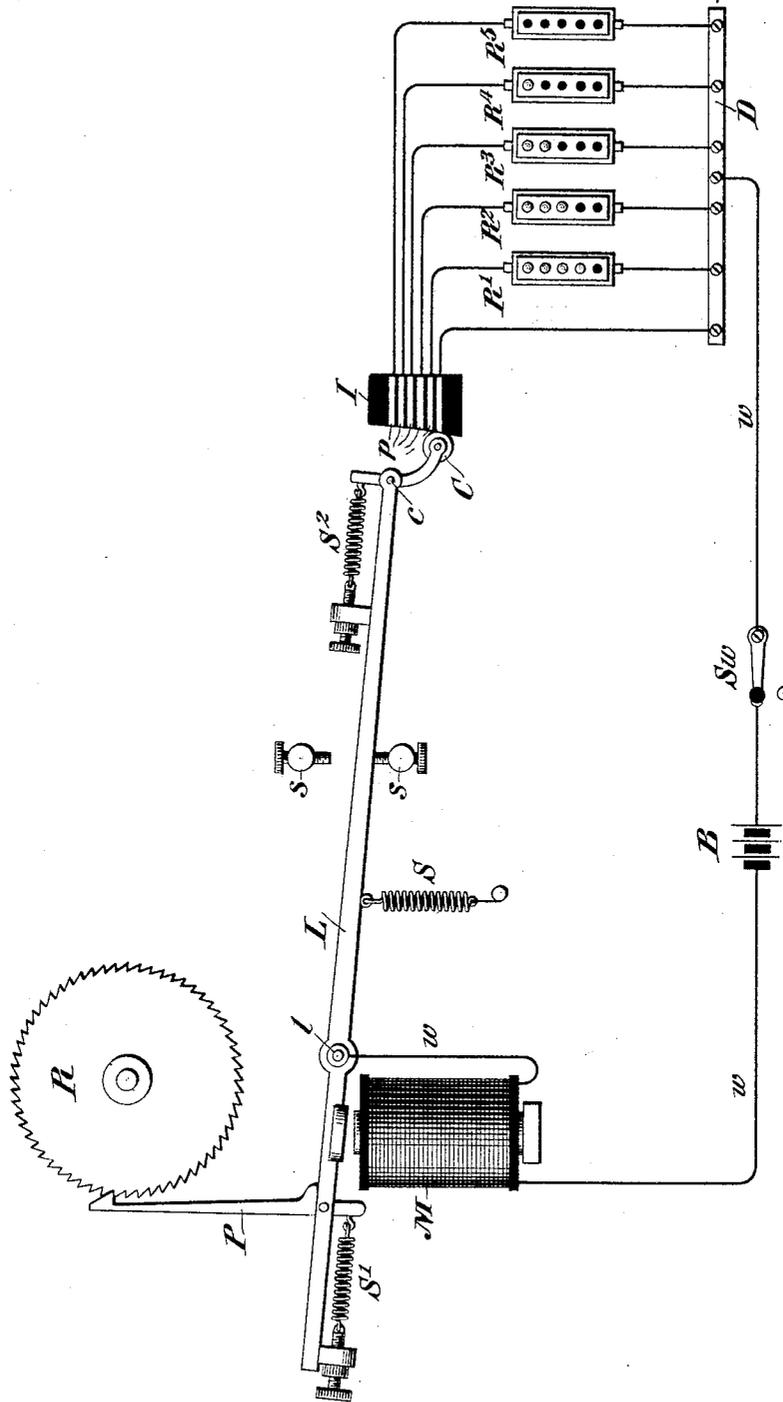


(No Model.)

R. CALLENDER.
ELECTRO MOTIVE DEVICE.

No. 498,763.

Patented June 6, 1893.



Witnesses
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UNITED STATES PATENT OFFICE.

ROMAINE CALLENDER, OF BRANTFORD, CANADA, ASSIGNOR OF TWO-THIRDS
TO EDWARD HART AND EDWARD L. GOOLD, OF SAME PLACE.

ELECTRO-MOTIVE DEVICE.

SPECIFICATION forming part of Letters Patent No. 498,763, dated June 6, 1893.

Application filed July 14, 1892. Serial No. 439,974. (No model.)

To all whom it may concern:

Be it known that I, ROMAINE CALLENDER, a subject of the Queen of Great Britain, residing at Brantford, Ontario, Canada, have invented certain new and useful Improvements in Electro-Motive Devices, of which the following is a specification.

My invention is directed particularly to improvements in electro-motive apparatus for utilizing energy through the application of electro-magnets, electro-magnetic solenoids, electric motors or analogous electro-magnetic apparatus and it has for its object, the regulation of the application of energy in such apparatus and in such manner as to cause the moving part of the apparatus through which power is transmitted to approach the stationary part at any desired speed, either throughout the entire distance through which it is adapted to move or through any portion or portions thereof.

With electro-magnets or solenoids as heretofore constructed, it has been customary to regulate wholly the relation between the speed with which the solenoid core or armature advances through the application of springs, dash pots, and numerous other appliances which necessarily utilize or waste a portion of the energy required in the operation of the apparatus. It is also a well known fact that the action of an electro-magnet upon its armature when energized, varies with the distance of the armature from the core, whether this variation be either directly as the distance between the two or inversely as the square of that distance as is held by some authorities is immaterial, in so far as my invention is concerned, it being a well known fact that the attractive power of a core for an armature decreases as the armature recedes from the core, the estimated amount of this difference in the attraction between the two at different distances being different as computed by different authorities.

In order that my invention may be fully understood, I have illustrated in the accompanying drawing in diagrammatic view, an apparatus showing the simplest application of the principles involved and for the purpose specified.

Referring to the drawing in detail, M is an

electro-magnet of well known form, and *w* a conductor connected to the terminals of the coil thereof, B being a battery. *Sw* is a switch and L an armature lever pivoted at *l* and provided with an armature located near the poles of the electro-magnet M, the conductor *w* being connected directly to the armature lever L at the pivot *l*.

s s are adjustable front and back stops for regulating the throw of the armature lever L and S is a spring secured to the lever L at one end and to a fixed point at the other.

P is a pivoted pawl carried near the outer end of the armature lever L, and R is a ratchet wheel through which the power from the armature lever L and pawl P is applied.

C is a roller made of metal or analogous conducting material and journaled in the end of a conducting lever pivotally secured to the right hand end of the lever L by a metallic pivot *c*.

S' and *S''* are yielding spiral springs provided with adjusting screws for regulating respectively the pressure of the pawl P upon the ratchet wheel R and roller C upon the free ends of a series of conducting plates *p* carried by an insulating block I and connected by conductors running to a metallic or conducting bar D.

R', *R''*, *R'''*, *R''''* and *R''''''* are adjustable rheostats or resistance boxes of any preferred form included in circuit with the aforesaid conductors, the arrangement being such that the resistance in any one of the branches may be adjusted to suit the ends of the user.

I have illustrated the rheostats *R'*, *R''*, &c., as having fixed proportions plugged up so that the resistance of the circuits reading from left to right increases in regular steps.

The operation of the apparatus therefore is as follows: The switch *Sw* is supposed to have been just closed and the armature lever L to be resting upon the lower stop *s* while the conducting roller C is resting upon that one of the conducting plates *p* which is in circuit with that one of the branch conductors having no rheostat or resistance box in its circuit. Consequently the maximum amount of current is allowed to flow from the battery B through the switch *Sw*, wire *w*, conducting bar D, branch circuit, roller C, pivot *c*, arma-

ture lever L, pivot *l*, conductor *w* and magnet M, thereby giving to the magnet a maximum magnetic capacity or saturation at that time when the armature is at its greatest distance from the core. As the armature and its armature lever L are drawn down against the stress of spring S, the pawl P imparts motion to the ratchet wheel R, but at the next step in advance the conducting roller C passes off from the lower plate *p* and on to the next one of said plates including in its circuit that branch which includes also the rheostat or resistance box R' which has only a small portion of its resistance in circuit, as shown by the absence of the lower conducting plug at the bottom of the box. This increased resistance therefore demagnetizes the electro-magnet M a proportionate amount, while the armature has advanced a fractional distance nearer the core thereof. So in succession the conducting roller C passes over the contact plates *p* and cuts into circuit the succeeding rheostats R², R³, &c., the resistance of the entire circuit increasing as the armature nears the core of the electro-magnet M so that when the armature rests upon the core or is at its lowest point, the rheostat or resistance box R⁵ alone will be in circuit with the magnet M, battery B and upper contact plate *p*. It will be understood therefore that by varying the resistance of the multiple or branch circuits connected to the conducting plates *p* and bar D, I may impart to the armature lever L a motion of any desired nature. In other words I may so vary the resistance of the branch circuits through the agency of the rheostats R' to R⁵ that I may make the speed of the armature constant for all portions of its excursion or journey, or I may vary the intermediate speed in any desired order.

It will be appreciated that the application of this generic principle of varying the speed of an armature or core at will in accordance with the wishes of the user may be applied in many places in the arts. To illustrate: It may be used in connection with time mechanism for regulating the speed of rotation of the time registering hands of a clock or with electric motors generally, having either vibratory or rotary armatures where it is wished to maintain constant or variable speed within any desired limits. It is obvious that the electro-magnet M and its armature may be replaced by a solenoid and solenoid core, and the same principle applied in connection with said parts.

It is also obvious that I may utilize any form of variable resistance to replace the rheostats or resistance boxes R' to R⁵ and that I may, with the aid of such resistance devices, regulate the application of magnetism for the transmission of energy through electro-magnetic apparatus generally.

My claims are to be construed broadly to the application of the generic principle herein described and through the agency of means which regulate the flow of current through

the actuating magnet in the proportions desired with relation to the position of the moving part thereof at the will of the user.

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

1. An electro-motive device consisting of an electro-magnet having an armature located in the magnetic field thereof and provided with means tending to withdraw it out of said field, in combination with circuit connections through the coils of the magnet and the armature lever for varying the current supply as it approaches the coil, said armature being operatively connected to mechanism to be propelled, substantially as described.

2. An electro-motive device consisting of an electro-magnet having an armature carried by an armature lever provided with a retractile spring and operatively connected to mechanism to be propelled, in combination with current varying devices operatively connected through the armature lever and the coils of the magnet whereby the movement is maintained constant throughout the forward stroke of the armature lever, substantially as described.

3. An electro-motive device consisting of an electro-magnetic coil, an armature or solenoid core therefor having circuit connections for varying the current from the source of current supply to the coil at will or in any desired order of variation in combination with an independent mechanism operatively connected to the armature or core and requiring a variable application of power, substantially as described.

4. An electro-motive device consisting of an electro-magnetic coil having circuit connections on one side with a source of electric energy and a series of variable resistances connected in multiple arc relation therewith; with an armature or solenoid core connected through a circuit changing device, with the aforesaid resistances on the other side of the coil, substantially as described.

5. An electro-motive device consisting of an electro-magnetic coil operatively connected on one side with a battery and a multiple arc series of variable resistance coils and on the other side through the armature lever with a circuit changing device carried thereby and having operative connection with the opposite ends of the variable resistances; the arrangement being such that the circuit changing device is in contact with the coil of lowest resistance when the armature is farthest from the pole of the magnet and vice versa, substantially as described.

6. An electro-motive device consisting of an electro-magnet having an armature and an armature lever operatively connected through a pawl to a ratchet mechanism and a variable resistance with a source of current supply and circuit connections carried by the movable armature lever, said connections being operatively connected through the smallest portion

of the variable resistance when the armature is farthest from the magnet core and through the greatest resistance when the armature is closely adjacent to said core, and through the other resistances in proportion to the distance of the armature from the core, whereby a continuous and steady pull is imparted to the ratchet wheel during the entire stroke of the armature lever, substantially as described.

7. An electro-motive device consisting of an electro-magnet M having an armature lever and a propelling pawl P engaging a ratchet wheel R in combination with a source of current supply and a multiple arc series of resistance coils connected on one side to the source of current supply and on the other side to a circuit changing device carried by the armature lever, the circuit connections being arranged so that the resistance coil of least resistance is in direct circuit with the magnet coil when the armature is farthest from the pole of the magnet and the coil of greatest resistance is in direct circuit therewith when the armature is nearest said pole, substantially as described.

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