(No Model.) 2 Sheets—Sheet 1.

M. V. B. ETHRIDGE & J. H. EASTMAN.

ELECTRIC CLOCK WINDING MECHANISM.

No. 536,926. Patented Apr. 2, 1895.

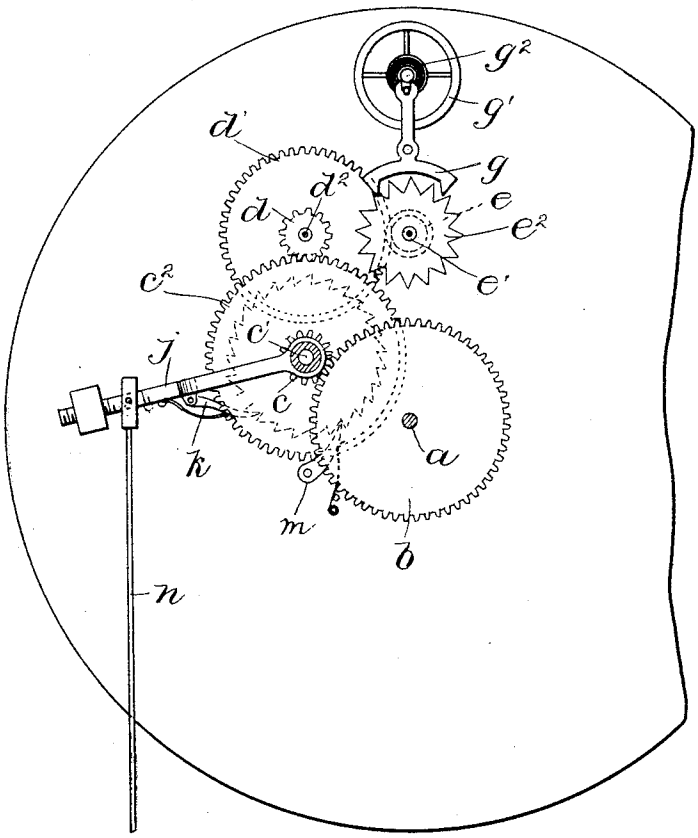

Fig. 1.

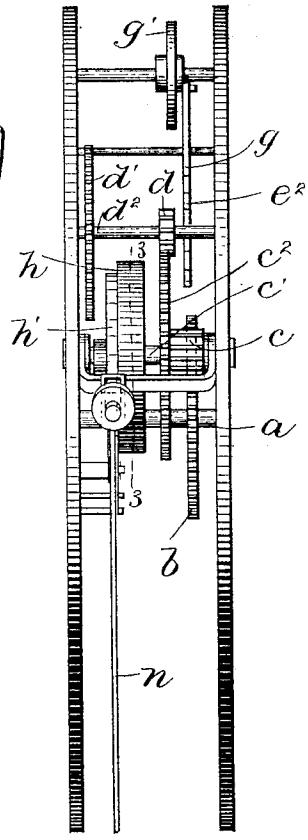

Fig. 2.

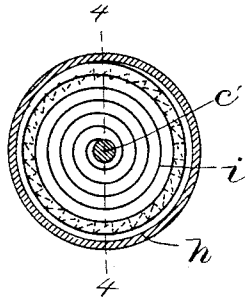

Fig. 3.

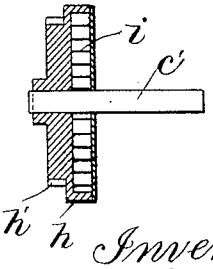

Fig. 4.

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A. D. Harrison.

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(No Model.) 2 Sheets—Sheet 2.

M. V. B. ETHRIDGE & J. H. EASTMAN.

ELECTRIC CLOCK WINDING MECHANISM.

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Fig. 5.

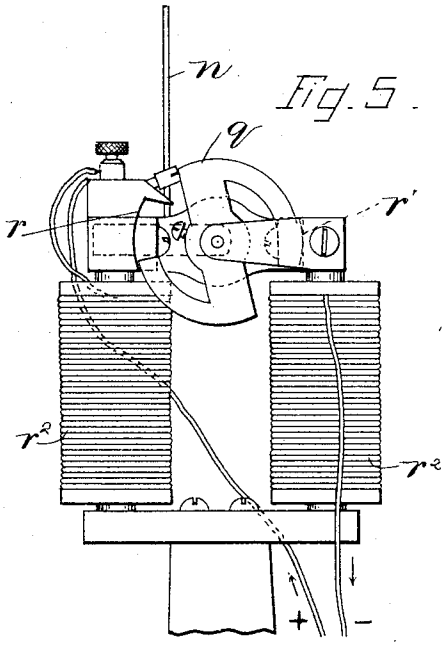
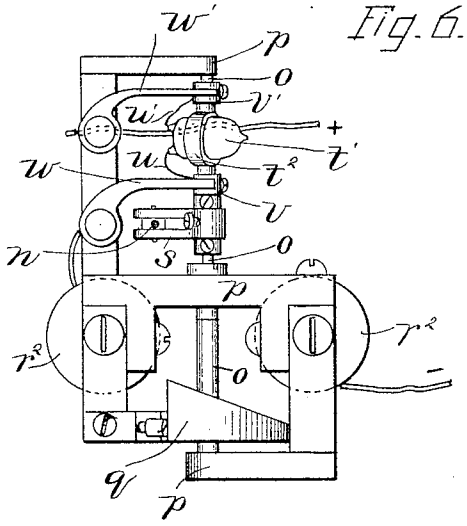


Fig. 6.



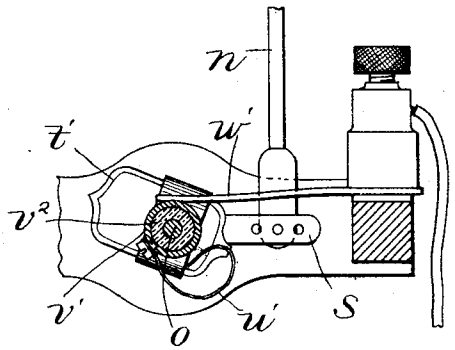


Fig. 7.

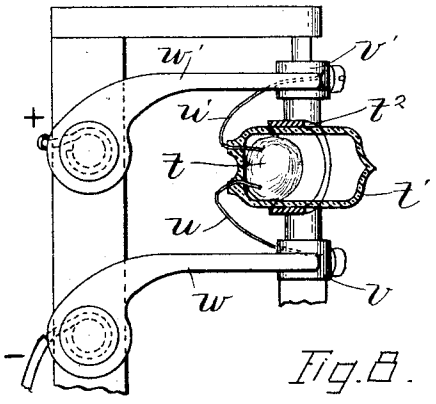


Fig. 8.

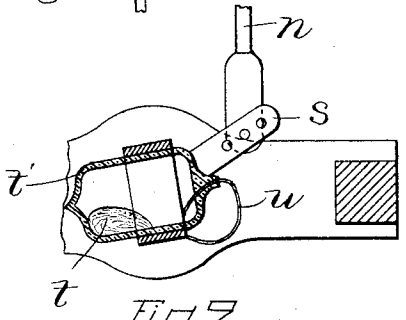


Fig. 9.

Witnesses:
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A. D. Harrison.

Inventors:
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J. H. Eastman
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UNITED STATES PATENT OFFICE.

MARTIN V. B. ETHRIDGE, OF EVERETT, AND JOSEPH H. EASTMAN, OF BOSTON, MASSACHUSETTS, ASSIGNORS TO THE CENTURY CLOCK COMPANY, OF NORTH BERWICK, MAINE.

ELECTRIC CLOCK-WINDING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 536,926, dated April 2, 1895.

Application filed April 28, 1894. Serial No. 509,326. (No model.)

To all whom it may concern:

Be it known that we, MARTIN V. B. ETHRIDGE, of Everett, in the county of Middlesex, and JOSEPH H. EASTMAN, of Boston, in the county of Suffolk, in the State of Massachusetts, have invented certain new and useful Improvements in Clocks, of which the following is a specification.

This invention has for its object, first, to provide a simple and accurate time movement, the impelling power of which shall be constant, so that there will be no variation in the time-keeping qualities caused by variations in the strength or force of the motor, and, secondly, to provide improved means for automatically maintaining the force which impels the said movement.

The invention consists in the improvements which we will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a side view of a part of a clock movement embodying our invention. Fig. 2 represents an edge view of the same. Fig. 3 represents a section on line 3—3 of Fig. 2. Fig. 4 represents a section on line 4—4 of Fig. 3. Figs. 5 to 9, inclusive, represent views of our improved mechanism for maintaining the operation of the time movement.

The same letters of reference indicate the same parts in all the figures.

In carrying out our invention, we provide a time train which as here shown, comprises a center arbor a; a center wheel b on said arbor; a pinion c, usually known as the third pinion, affixed to an arbor c', carrying a gear wheel c^2 known as the third wheel; a pinion d known as the fourth pinion, meshing with the third wheel c^2; a wheel d' known as the fourth wheel, affixed to the arbor d^2 carrying the pinion d; a pinion e affixed to the arbor e' which carries the escape wheel e^2; and a pallet g; balance wheel g'; and hair spring g^2 controlling the movement of the said train.

The parts above mentioned comprise a simple train adapted for use in connection with our improvements hereinafter described; but we desire it understood that we do not limit ourselves to the particular time train here shown, and may use any other with which our said improvements are capable of use.

h represents a barrel which is mounted loosely upon the arbor c', and contains a spiral spring i, the outer end of which is affixed to said barrel, while the inner end is affixed to the arbor c', the said spring constituting a connection between the barrel and the arbor c', so that power is imparted to the arbor through said spring. Affixed rigidly to the barrel h is a ratchet h'.

k represents a pawl mounted upon an arm j, which is adapted to oscillate on the arbor c'. The arm j is weighted, so that when raised and then allowed to descend by gravitation, it will impart to the barrel h and spring i, through the pawl k and ratchet h', a sufficient force to compress the spring i and impart through the latter and the arbor c' a sufficient force to impel the time train, the spring being compressed by the described action of the arm j, so that it is in effect a rigid connection between the barrel and the arbor c' during the downward movement of said arm. When the arm j is raised, the ratchet h' is prevented from rotating backward by a stop pawl m engaged with it as shown in Fig. 1, so that the spring i is caused to act upon the arbor c', and continues the rotation of said arbor and of the other arbors of the train. It will be seen, therefore, that power is applied continuously to the train, first by the direct action of the arm j, and then by the action of the spring, the arm and spring acting alternately. The arm may be operated by means of a connecting-rod n engaged with the lower end of the slide, said rod being connected with a suitable motor adapted to alternately raise and release it. A motor suitable for this purpose is shown in Figs. 5 to 9 inclusive, in which o represents a horizontal shaft journaled in fixed bearings $p\ p\ p$. To said shaft is affixed an armature q which is formed to oscillate between the curved pole pieces $r\ r'$ of the electro-magnet $r^2\ r^3$. Said magnet is included in an electric

circuit, which also includes a battery or other source of electricity. To the shaft *o* is affixed an arm *s* to which the rod *n* is pivotally connected.

When the circuit is closed and the electro-magnet energized, the poles *r r'* attract the armature *q*, giving the latter and the shaft *o* a movement which raises the arm *s* and rod *n*, thus raising the weighted arm *j*. This movement of the shaft also causes a circuit controller carried thereby to break the circuit, so that as soon as the rod *n* and arm *j* are raised, the armature is released by the magnet, and permits the descent of said arm and rod, the armature being thus gradually moved away from the poles *r r'*. When the arm *j* and rod *n* have reached the lowest point in their movement, the circuit controller acts to close the circuit, and thus cause the upward movement of the rod *n* and arm *j*. The operation is thus continued, the magnet being energized at the end of each downward movement of the weighted arm *j* and demagnetized at the end of each upward movement, so that said arm is alternately raised and released, with the result above described.

We prefer to employ as the circuit controller a body *t* of metallic mercury, a hermetically sealed glass tube *t'* inclosing said body, and contact wires *u u'* included in the circuit and projecting into the tube *t'*. The tube *t'* is arranged so that when the weighted arm *j* and rod *n* reach the lower end of their movement the body *t* will gravitate to the position shown in Figs. 7 and 8, and establish an electrical connection between the wires *u u'*, thus closing the circuit. When the arm *j* and rod *n* reach the upper end of their movement the tube *t'* is inclined as shown in Fig. 9, thus separating the body *t* from the wires *u u'* and breaking the circuit.

The tube *t'* is held in a ring or clamp t^2 affixed to the shaft *o*, and may be readily removed from said clamp, so that a new circuit controller may be applied in case of necessity. Air is exhausted from the tube to prevent oxidation of the mercury. As the wires *u u'* necessarily have an oscillating motion, it is desirable to connect them with the fixed parts of the circuit, by means which will offer practically no resistance to said motion. To this end we connect the wires *u u'* with metallic collars *v v'* attached to the shaft *o* and insulated therefrom by insulating collars v^2 (Fig. 7), and employ springs *w w'* bearing on said collars *v v'* and connected with fixed parts of the circuit.

The weighted arm *j* may be termed a primary motor, and the spring *i* may be termed a secondary motor, through which power is transmitted from the train to the primary motor, said secondary motor acting on the train when the primary motor is being set for action; or in other words, when the arm *j* is being raised.

It will be seen that the shaft *o*, arm *s*, and rod *n* constitute a mechanical connection between the armature and the primary motor, whereby the action of the armature when the circuit is closed is caused to set the motor for action, and that said shaft, arm, and rod constitute also a mechanical connection between the motor and the circuit controller, whereby the motor is caused, after it has been set, to again close the circuit, so that the action of the armature in setting the motor breaks the circuit, while the action of the motor closes the circuit.

We believe it to be new with us to combine with a time train a motor such as the weighted arm *j*, a train impelling spring adapted to be wound by the action of said arm, an electric circuit including an electro-magnet, an armature controlled by said magnet and mechanically connected with the motor so that the movement of the armature caused by its attraction to the poles of the magnet sets the motor for action, and a circuit controller also mechanically connected with the motor and with the armature, and adapted to be operated by the motor to close the circuit when the motor has nearly spent its force, and by the armature to break the circuit after the motor has been set. We do not, therefore, limit ourselves to the mechanical details of construction here shown, and may vary and depart from the same without departing from the spirit of our invention.

We claim—

1. The combination, with a time train, of a motor, an electric circuit including an electro-magnet, an armature controlled by said magnet, a circuit controller composed of a hermetically closed tube mechanically connected with the armature, a gravitating circuit closing and breaking device, and circuit terminals within said tube, and mechanical connections between the motor and the connected armature and circuit controller, through which the motor is set for action by the armature when the circuit is closed, and the circuit controller is caused to close the circuit when the motor is expending its force, as set forth.

2. The combination, with a time train, of a motor, an electric circuit including an electro-magnet, a shaft provided with an armature, a circuit controller supported by said shaft and composed of an exhausted tube, a gravity circuit closing and breaking device in said tube, and circuit terminals connected with the tube, insulated collars on said shaft connected with said terminals, springs bearing on said collars and connected with fixed parts of the circuit, and mechanical connections between the shaft and motor, as set forth.

3. A circuit controller composed of an exhausted tube of insulating material, circuit wires projecting into the tube and normally separated and insulated from each other thereby, and a gravity circuit closing and

breaking device, such as a body of mercury located in said tube, adapted to electrically connect said wires, as set forth.

4. The combination of a balance, an escapement, a train connected with said escapement, a spring adapted to impel said train, a ratchet wheel connected with said spring and having a stop pawl to prevent retrograde movement, a vertically movable weight such as *j* provided with a pawl engaging said ratchet, an electric circuit, an electro magnet included therein, a shaft carrying the armature of said magnet and provided with an arm *s*, a rod connecting said arm with the weight *j*, and a circuit controller actuated by the movements of said shaft as set forth.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 25th day of April, A. D. 1894.

MARTIN V. B. ETHRIDGE.
JOSEPH H. EASTMAN.

Witnesses:
C. F. BROWN,
E. BATCHELDER.