No. 770,322. PATENTED SEPT. 20, 1904.

H. SCOTT.

ELECTRIC CLOCK.

APPLICATION FILED SEPT. 17, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1,

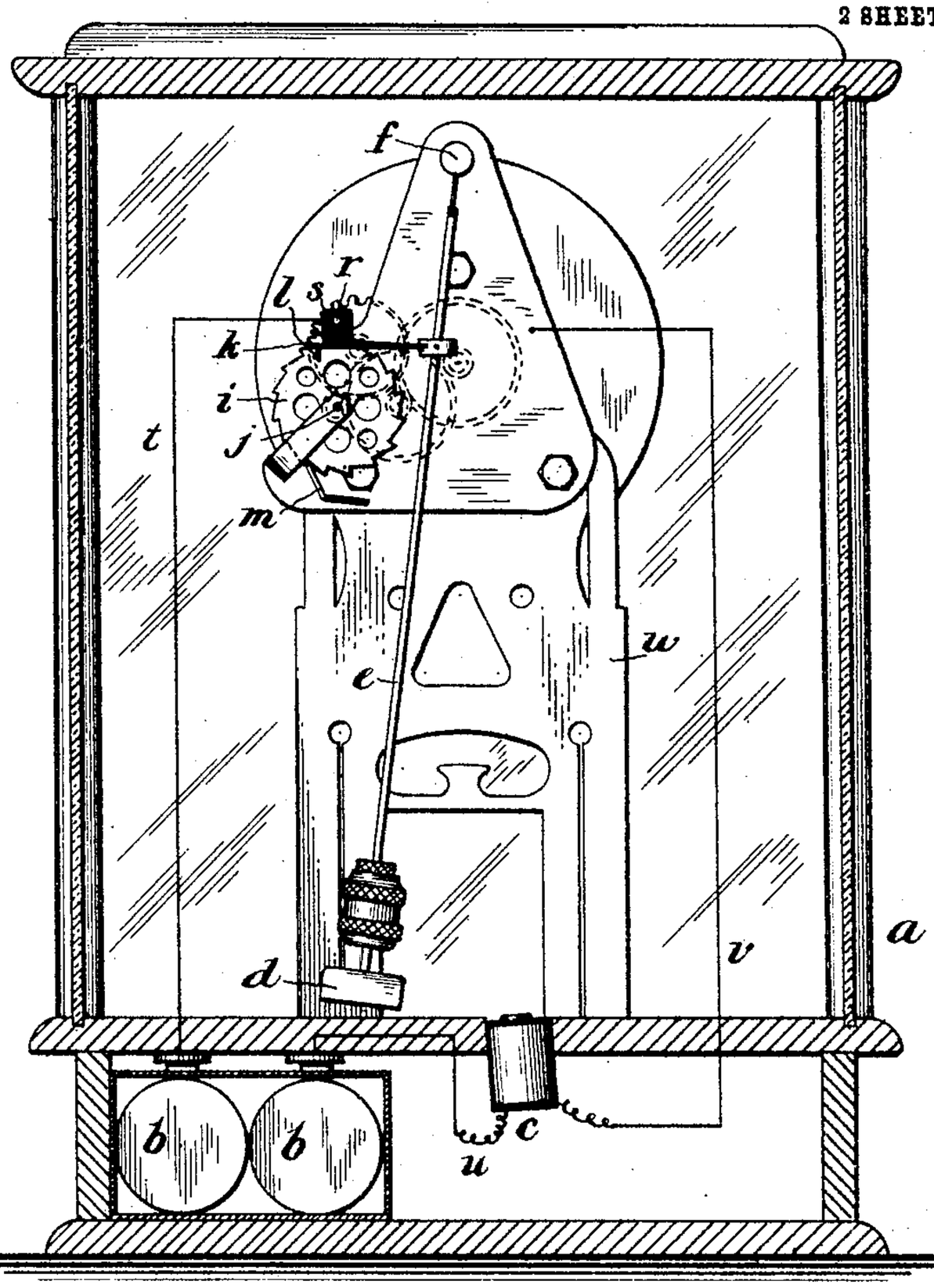


Fig. 3,

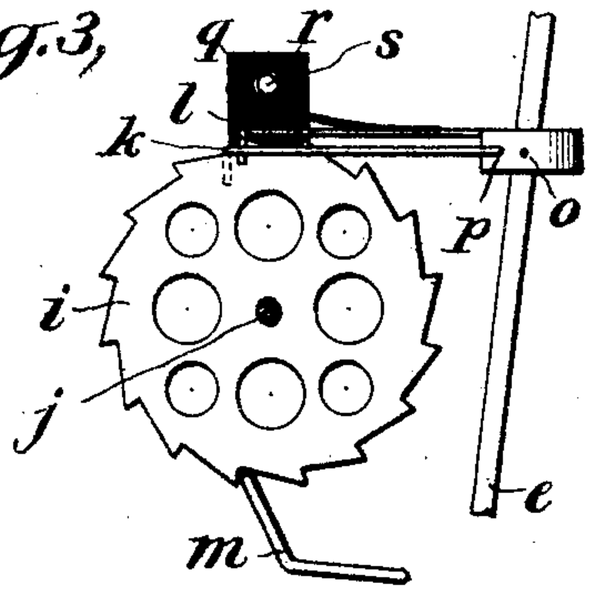
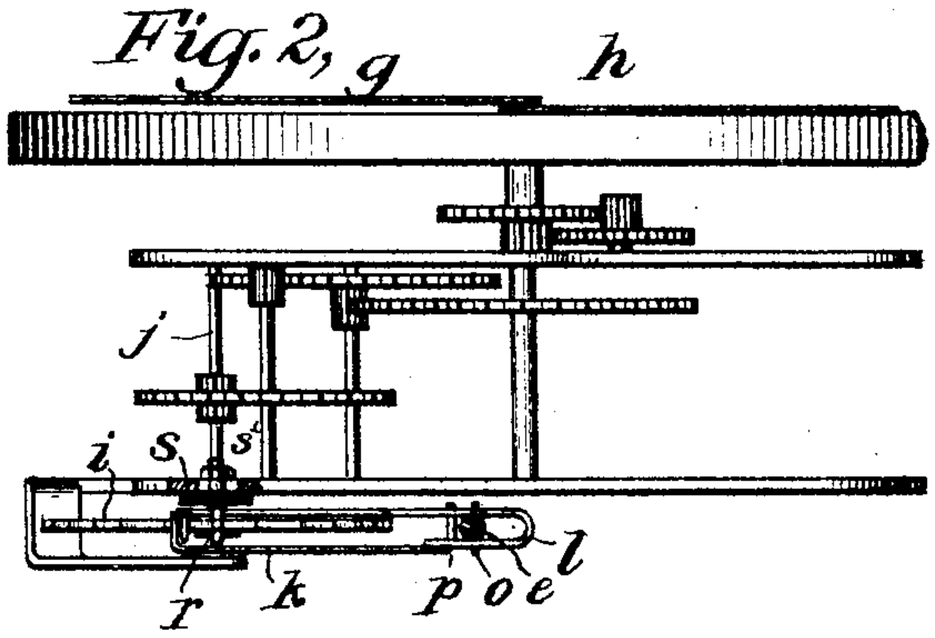


Fig. 2,



WITNESSES:

J. H. Barnes

J. A. d'Estre.

INVENTOR

Herbert Scott

BY

Henry D. Williams

ATTORNEY

No. 770,322. PATENTED SEPT. 20, 1904.

H. SCOTT.

ELECTRIC CLOCK.

APPLICATION FILED SEPT. 17, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 4,

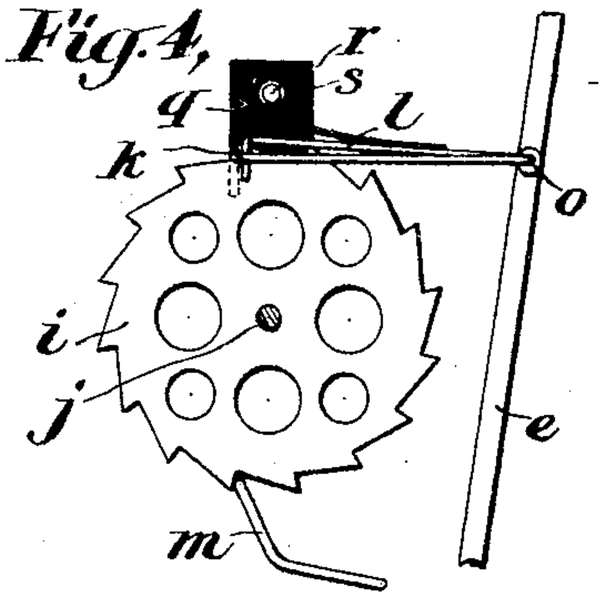


Fig. 5,

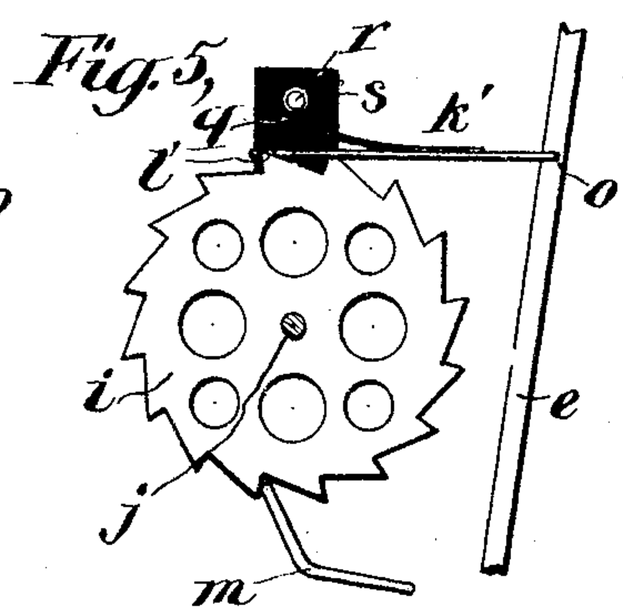


Fig. 6,

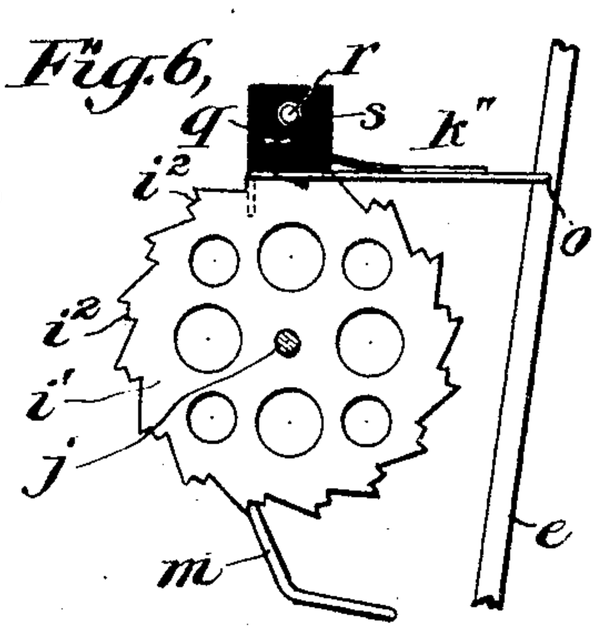


Fig. 7,

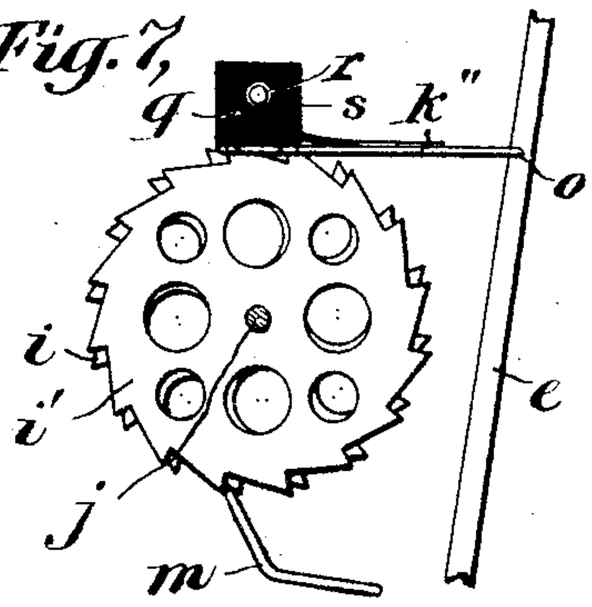


Fig. 9,

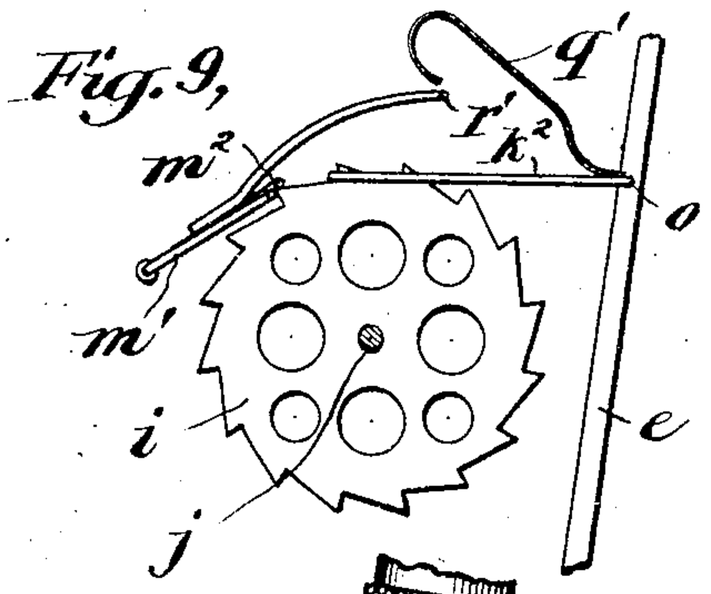


Fig. 8,

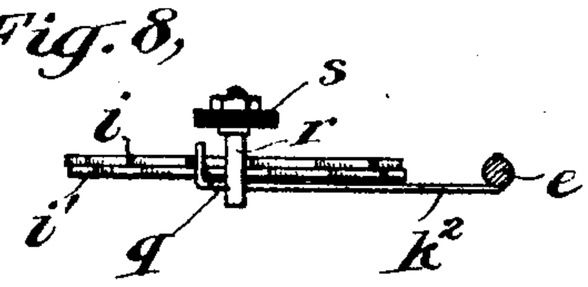


Fig. 10,

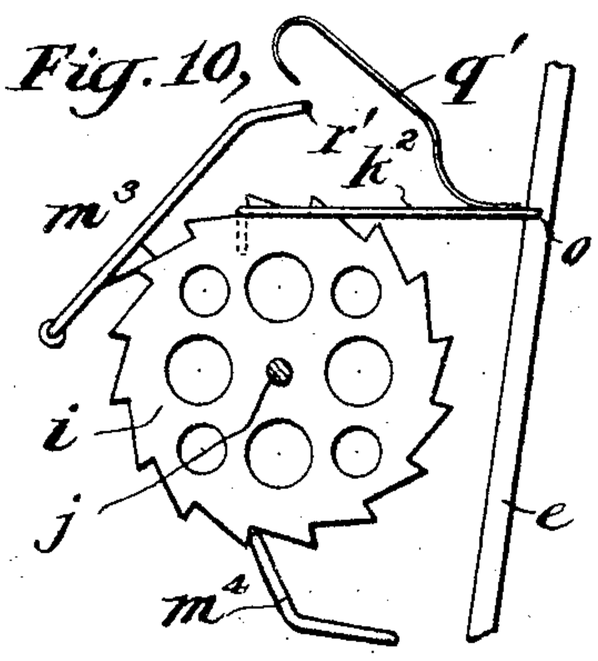


Fig. 11,

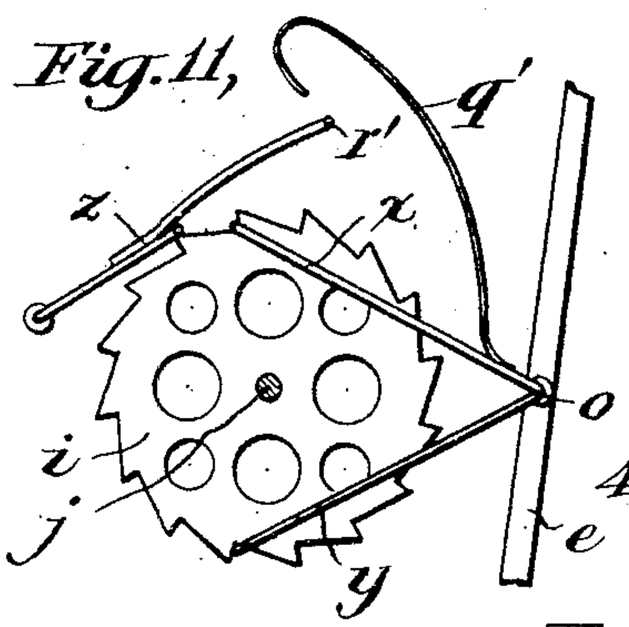
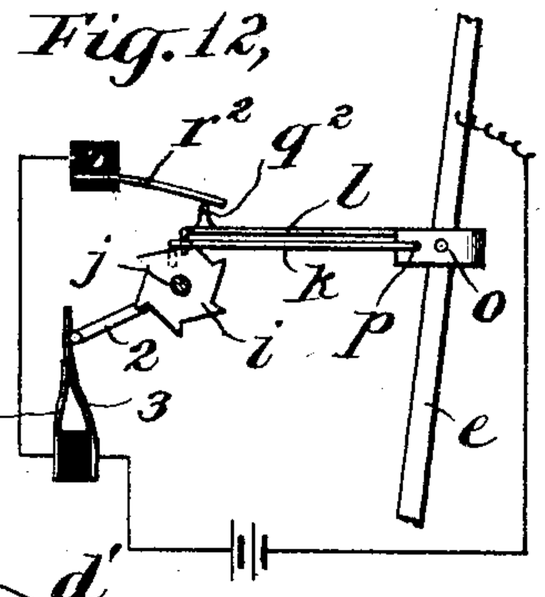


Fig. 12,

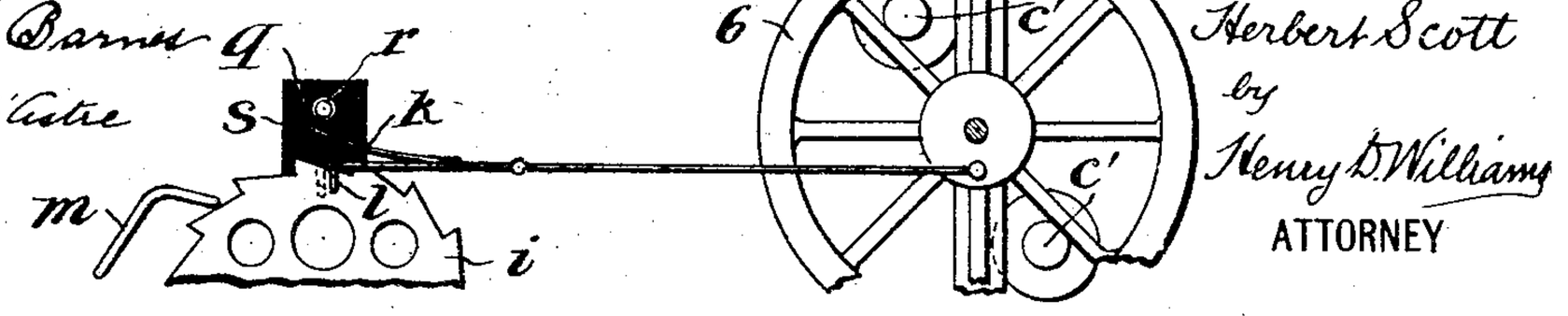


WITNESSES:

J. H. Barnes

J. A. d'Eastre

Fig. 13,



INVENTOR

Herbert Scott

by

Henry D. Williams

ATTORNEY

No. 770,322. Patented September 20, 1904.

UNITED STATES PATENT OFFICE.

HERBERT SCOTT, OF BRADFORD, ENGLAND.

ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 770,322, dated September 20, 1904.

Application filed September 17, 1902. Serial No. 123,689. (No model.)

To all whom it may concern:

Be it known that I, HERBERT SCOTT, a subject of the King of England, residing at Bradford, in the county of York, England, have invented certain new and useful Improvements in Electric Clocks, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to electric clocks, instruments, or machines in which a pendulum balance-wheel or torsion-wheel driving a train of wheels or other mechanism is kept in motion by the intermittent action or energization of electrically-controlled or electromagnetic means.

Heretofore attempts have been made to construct electric clocks in which the electromagnet is energized when the swing or amplitude of the pendulum falls below the normal; but they have failed owing to the complication and delicacy of the current-closers employed and to the necessary friction entailed by the added mechanism and to the interruption of the current caused by the fouling of the contact-points.

My invention has for its objects to simplify and cheapen the construction and to insure the reliability of such clocks, instruments, or machines by providing for the energization of the electromagnet at the proper time without the addition of any apparatus other than that required to drive the train of wheels and thereby to reduce the friction of the working parts to a minimum, to insure that when the swing or amplitude of the pendulum or the rotary movement of the balance or torsion wheel has fallen below the normal the circuit shall be closed and opened at the exact points desired and during the smallest possible and most efficient part of the arc described by the pendulum or balance wheel or torsion wheel, and to provide for the self-cleaning of the contact-points by means of a wiping or moving contact.

My invention is applicable to clocks, self-registering barometers, and the like, workman's telltale-check instruments, advertising machines or toys, or any similar instruments or machines in which a train of wheels or any other mechanism is required to be driven, and may also be employed to wind up the spring of any instrument or machine or of the striking-train of a striking-clock.

My invention includes various features of construction and of combination of parts, as will appear from the particular description hereinafter contained of the apparatus embodying my invention, (shown in the accompanying drawings,) and I will now particularly describe such apparatus and will thereafter point out my invention in claims.

Figure 1 is a rear elevation of a pendulum-clock containing apparatus embodying my invention. Fig. 2 is a plan view of the same. Fig. 3 is an enlarged elevation showing a position of parts upon a diminished movement of the pendulum. Figs. 4, 5, and 6 are detail elevations of different modified constructions. Fig. 7 is a detail elevation, and Fig. 8 a detail plan, of another modified construction. Figs. 9 to 13, inclusive, are detail elevations of other modified constructions.

The clock shown in Fig. 1 comprises as a suitable casing *a*, in the lower part of which is located a battery *b*, which supplies electric current to an electromagnet *c*, this electromagnet being fixed in the clock-casing and being adapted to attract an armature *d* and the armature being carried at the lower end of and constituting part of a pendulum of which the rod *e* is hung at its upper end on a stud *f*, as usual. The fixed electromagnet *c* and its armature *a*, carried by the pendulum, constitute the impelling means which give an impetus to the pendulum, the construction being such that the circuit is closed at the exact moment when the armature approaches the electromagnet and remains closed for the period required to give the desired impetus to the pendulum, and the arrangement shown is such that the circuit is closed and opened as the pendulum approaches the extremity of an oscillation. A suitable train of gears is provided to actuate the hands *g* and *h*, (see Fig. 2,) and this train of gears is actuated by a toothed moving part, which is shown as the ratchet-wheel *i*, fixed upon the arbor *j* of the first pinion of the train of gears, and this ratchet-wheel is actuated by the pendulum and

constitutes the driving part of the clock-train. For the purpose of actuating the ratchet-wheel I provide engaging means for the ratchet-wheel, such engaging means being partly controlled by the movement of the pendulum or oscillating means and partly controlling the ratchet-wheel to prevent backward movement thereof, and in the construction shown in the main views of the drawings, Figs. 1 to 3, inclusive, this engaging means comprises two pawls *k* and *l*, actuated by the pendulum and also comprises a stop-pawl or click *m*, having a fixed support. The pawl *l* is set so as to engage the ratchet-wheel slightly in advance of the pawl *k*, and, as shown, the advance pawl *l* is pivoted on the pin *o*, which passes through the pendulum-rod *e*, and the rear pawl *k* is pivoted upon the advance pawl *l* at the point *p* in proximity to the pivotal point of the advance pawl *l*. The advance pawl *l* carries a contact-finger *q*, which is adapted to make contact with a fixed pin *r*, held on an insulating-block *s*. The contact-pin *r* is connected to one of the terminals of the battery *b* by a wire *t*, and the other terminal of the battery *b* is connected by a wire *u* to the electromagnet *c*, and from the electromagnet *c* and wire *v* is connected to the metallic frame *w*, so that when the finger *q* comes in contact with the pin *r* the circuit is closed through the electromagnet *c*, and the electromagnet is energized. With the normal swing of the pendulum the two pawls *k* and *l* will be moved over and in rear of a tooth of the ratchet-wheel *i*, and on the return stroke of the pendulum the advance pawl *l* will engage with the tooth and move the ratchet-wheel one tooth, and these movements will be continued without closing the circuit, the stop-pawl or click *m* preventing backward movement of the ratchet-wheel *i*. When, however, the swing of the pendulum diminishes, so that the advance pawl *l* is not carried over and in rear of the next tooth of the ratchet-wheel, this advance pawl will remain on top of this tooth, but the rear pawl *k* will be carried over and in rear of and will engage with the tooth, and the parts will then be in the position shown in Fig. 3, and on the return stroke of the pendulum the rear pawl *k* will engage with the tooth and actuate the ratchet-wheel, and the advance pawl *l* will ride upon the ratchet-tooth, and by reason of the higher position of the advance pawl the contact-finger *q* carried thereby will be brought into contact with the fixed pin *r* as the armature *d* on the pendulum approaches the electromagnet *c*, and the circuit will be closed at just the right time to give an impetus to the pendulum and will be opened at the proper time and before the completion of the swing of the pendulum. The return movement of the pendulum will cause the advance pawl *l* to drop in rear of the ratchet-tooth, and on this return movement there will be no contact of the contact-finger *q* and fixed pin *r*, and the pendulum will have received a sufficient impetus to restore the normal swing, and the advance pawl will be carried over the next tooth, and the movements will be continued, as first above described, until the swing of the pendulum again falls below the normal. The movement of the contact-finger *q* effects a wiping contact with the fixed pin *r*, thereby rubbing the contact-points and preventing fouling thereof. The fixed contact-pin *r* may be adjustably held in any suitable manner so that the points and duration of contact may be nicely determined, as by providing the screw *s'*, which clamps the insulated block *s* to the frame with a slotted hole in the frame, as indicated.

In the modified construction shown in Fig. 4 the pawl mechanism comprises two pawls *k* and *l*, as above described; but these pawls are separately pivoted at the same point on the pendulum-rod.

In the modified construction shown in Fig. 5 the pawl mechanism comprises a single pawl *k'*, which is provided with a step *l'* and which normally moves over and in rear of the next tooth, so that the main part of the pawl will engage with the tooth and the pawl will drop to the bottom of the tooth. Upon a diminished swing of the pendulum the step *l'* only will engage with the tooth and the pawl will be carried forward in higher position and will close the circuit of the impelling means, as above described.

In the modified construction shown in Fig. 6 the ratchet-wheel *i'* is made with a step or notch i^2 in each tooth, and a single driving-pawl k^2 is provided. When the swing of the pendulum diminishes, the driving-pawl rides upon the step or notch i^2 and makes contact, as above described.

In the modified construction shown in Figs. 7 and 8 two ratchets *i* and *i'*, both fixed to the arbor *j*, and the ratchet *i'*, set slightly in advance of the ratchet *i*, take the place of the stepped ratchet of the modification shown in Fig. 6.

In the modified construction shown in Fig. 9 the stop-pawl or click *m'* is provided with a step m^2 and is also provided with a contact-pin *r'*, and the contact-finger *q'*, carried by the driving-pawl k^2, makes contact with this contact-pin *r'* when, upon a diminished stroke of the pendulum, the step of the stop-pawl *m'* engages a tooth of the ratchet-wheel.

In the construction just described and shown in Fig. 9 and in the other constructions, (shown in Figs. 10 and 11,) in which the contact-pin is carried by the stop-pawl, the impelling-electromagnet *c* is placed in proximity to the left-hand extremity of the swing of the pendulum, as shown in Fig. 9, whereas in all other pendulum constructions shown the impelling-electromagnet is placed in proximity to the right-hand extremity of the pendulum, as shown in Fig. 1.

In the modified construction shown in Fig. 10 two stop-pawls or clicks m^3 and m^4 are provided, one slightly in advance of the other, in place of the stepped stop-pawl or click of the modification shown in Fig. 9.

In the modified construction shown in Fig. 11 I employ two driving-pawls x and y, the driving-pawl x acting on the top side of the ratchet-wheel on one swing of the pendulum and the driving-pawl y acting on the under side of the ratchet-wheel on the return swing of the pendulum. I employ a pawl or click z, with a contact-pin mounted thereon, adapted to coöperate with a contact-finger carried by the upper driving-pawl. With a diminished swing of the pendulum the pawl or click z remains on the top of a ratchet-tooth and in this position makes contact with the contact-finger z.

In the modified construction shown in Fig. 12 I provide two breaks in the electric circuit, one of which is closed at fixed intervals and the other of which is closed upon a diminished swing of the pendulum. The contact closed at fixed intervals is provided by an arm 2 on the ratchet-wheel i, which closes the fingers 3 and 4 upon each other by contact with the finger 3 once in every revolution of the ratchet-wheel. The closing of the other break in the circuit upon a diminished swing of the pendulum is effected by mechanism substantially the same as shown in the main views of the drawings except that the advance pawl 1 carries a contact-pin q^2, which coöperates with an adjustable fixed contact-finger r^2.

In the modified construction shown in Fig. 13 a balance or torsion wheel 6 takes the place of the pendulum and carries an armature d', which is arranged so as to be attracted by an electromagnet c'. The ratchet-wheel i and the two driving-pawls k and l are constructed and operate in the same manner as shown in the main views of the drawings.

It is obvious that other modifications may be made in the constructions shown and described within the spirit and scope of my invention.

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

1. The combination, with a toothed movable part and mechanism actuated thereby, of oscillating means, electrically-controlled impelling means for the oscillating means, and engaging means for the toothed part, such engaging means being in part controlled by the movement of the oscillating means to actuate the toothed part and in part controlling the toothed part to prevent backward movement thereof and including a circuit-controller controlling the impelling means and such engaging means and toothed part being constructed to coact to move the engaging means into position to energize the impelling means upon a diminished movement of the oscillating means.

2. The combination, with a ratchet-wheel, of oscillating means, electrically-controlled impelling means for the oscillating means, and engaging means for the ratchet-wheel, such engaging means being in part controlled by the movement of the oscillating means to actuate the ratchet-wheel and in part controlling the ratchet-wheel to prevent backward movement thereof and such engaging means including a circuit-closer adapted to close the circuit for the impelling means and such engaging means and ratchet-wheel being constructed to coact to move the engaging means into circuit-closing position upon a diminished movement of the oscillating means and to close such circuit only when the oscillating means is in position to receive an impulse from the impelling means.

3. The combination, with a toothed movable part and mechanism actuated thereby, of oscillating means, electrically-controlled impelling means for the oscillating means, and engaging means for the toothed part, such engaging means being in part controlled by the movement of the oscillating means to actuate the toothed part and in part controlling the toothed part to prevent backward movement thereof and such engaging means including a circuit-closer adapted to make a wiping contact to close the circuit for the impelling means and such engaging means and toothed part being constructed to coact to move the engaging means into circuit-closing position upon a diminished movement of the oscillating means.

4. The combination, with a ratchet-wheel, of oscillating means, electrically-controlled impelling means for the oscillating means and engaging means for the ratchet-wheel, such engaging means being in part controlled by the movement of the oscillating means to actuate the ratchet-wheel and in part controlling the ratchet-wheel to prevent backward movement thereof and such engaging means including a circuit-closer adapted to make a wiping contact to close the circuit for the impelling means and such engaging means and ratchet-wheel being constructed to coact to move the engaging means into circuit-closing position upon a diminished movement of the oscillating means and to close such circuit only when the oscillating means is in position to receive an impulse from the impelling means.

5. The combination, with a toothed movable part, and mechanism actuated thereby, of oscillating means, electrically-controlled impelling means for the oscillating means, and pawl mechanism for the toothed part controlled by the movement of the oscillating means to actuate the toothed part, such pawl mechanism including a circuit-controller controlling the impelling means and such pawl mechanism and toothed part being constructed so that the pawl mechanism will ride upon a tooth of the toothed part and be moved by the oscil-

lating means into position to energize the impelling means upon a diminished movement of the oscillating means.

6. The combination, with a ratchet-wheel, of oscillating means, electrically-controlled impelling means for the oscillating means, and pawl mechanism for the ratchet-wheel controlled by the movement of the oscillating means to acutate the ratchet-wheel, such pawl mechanism including a circuit-closer adapted to close the circuit for the impelling means and such pawl mechanism and ratchet-wheel being constructed so that the pawl mechanism will ride upon a tooth of the ratchet-wheel upon a diminished movement of the oscillating means and close the circuit for the oscillating means only when the oscillating means is in position to receive an impulse from the impelling means.

7. The combination, with a toothed movable part and mechanism actuated thereby, of oscillating means, electrically-controlled impelling means for the oscillating means, and pawl mechanism for the toothed part controlled by the movement of the oscillating means to actuate the toothed part, such pawl mechanism including a circuit-closer adapted to make a wiping contact to close the circuit for the impelling means and such pawl mechanism and toothed part being constructed so that the pawl mechanism will ride upon a tooth of the toothed part upon a diminished movement of the oscillating means and be moved by the oscillating means into and out of circuit-closing position as the oscillating means is approaching the extremity of an oscillation.

8. The combination, with a ratchet-wheel and mechanism actuated thereby, of oscillating means, electrically-controlled impelling means for the oscillating means, two driving-pawls for the ratchet-wheel, one in advance of the other and both controlled by the movement of the oscillating means, one of such pawls controlling a circuit-controller to energize the impelling means upon a diminished movement of the oscillating means; and means for preventing backward movement of the ratchet-wheel.

9. The combination, with a ratchet-wheel, of oscillating means, electrically-controlled impelling means for the oscillating means, two driving-pawls of the ratchet-wheel, one in advance of the other and both controlled by the movement of the oscillating means, a circuit-closer carried by the rear driving-pawl and adapted to close the circuit for the impelling means when the rear driving-pawl rides upon a tooth of the ratchet-wheel upon a diminished movement of the oscillating means and to close such circuit only when the oscillating means is in position to be actuated by the impelling means, and means for preventing backward movement of the ratchet-wheel.

10. The combination, with a ratchet-wheel and mechanism actuated thereby, of oscillating means, electrically-controlled impelling means for the oscillating means, two pawls for the ratchet-wheel, one in advance of the other and both controlled by the movement of the oscillating means, a circuit-closer carried by one of such pawls and adapted to make a wiping contact to close the circuit for the impelling means, the pawl carrying the circuit-closer being constructed to ride upon a tooth of the ratchet-wheel upon a diminished movement of the oscillating means and to be moved by the oscillating means into and out of circuit-closing position as the oscillating means is approaching the extremity of an oscillation; and means for preventing backward movement of the ratchet-wheel.

11. The combination, with a ratchet-wheel and mechanism actuated thereby, of a pendulum, electromagnetic impelling means therefor, and engaging means for the ratchet-wheel in part carried by the pendulum and in part controlling the ratchet-wheel to prevent backward movement thereof, such engaging means including a circuit-closer adapted to close the circuit of the electromagnetic impelling means and such engaging means and ratchet-wheel being constructed to coact to move the engaging means into circuit-closing position upon a diminished movement of the pendulum.

12. The combination, with a ratchet-wheel, of a pendulum, electromagnetic impelling means therefor, and engaging means for the ratchet-wheel in part carried by the pendulum and in part controlling the ratchet-wheel to prevent backward movement thereof, such engaging means including a circuit-closer adapted to close the circuit of the electromagnetic impelling means and such engaging means and ratchet-wheel being constructed to coact to move the engaging means into circuit-closing position upon a diminished movement of the pendulum and to close such circuit only when the pendulum is in position to receive an impulse from the impelling means.

13. The combination, with a ratchet-wheel and mechanism actuated thereby, of a pendulum, electromagnetic impelling means therefor, and engaging means for the ratchet-wheel in part carried by the pendulum and in part controlling the ratchet-wheel to prevent backward movement thereof, such engaging means including a circuit-closer adapted to make a wiping contact to close the circuit of the electromagnetic impelling means and such engaging means and ratchet-wheel being constructed to coact to move the engaging means into circuit-closing position upon a diminished movement of the pendulum and to close such circuit only when the pendulum is in position to receive an impulse from the impelling means.

14. The combination, with a ratchet-wheel and mechanism actuated thereby, of oscillating means, impelling means therefor, and pawl mechanism for the ratchet-wheel controlled

by the movement of the oscillating means to actuate the ratchet-wheel, such pawl mechanism carrying a circuit-closing finger, a contact-pin with which such circuit-closing finger is adapted to cöoperate to close the circuit for the impelling means, such pawl mechanism being constructed to ride upon a tooth of the ratchet-wheel upon a diminished movement of the oscillating means and to be moved by the oscillating means into and out of circuit-closing position as the oscillating means is approaching the extremity of an oscillation, substantially as set forth.

15. The combination with a ratchet-wheel and mechanism actuated thereby, of a pendulum, electromagnetic impelling means therefor, two pawls for the ratchet-wheel, one in advance of the other and both carried by the pendulum, a circuit-closing finger carried by one of such pawls, and a contact-pin with which such circuit-closing finger is adapted to coöperate to close the circuit for the electromagnetic impelling means, the pawl carrying the circuit-closing finger being constructed to ride upon a tooth of the ratchet-wheel upon a diminished movement of the pendulum and to be moved by the pendulum into and out of circuit-closing position as the pendulum is approaching the extremity of an oscillation, substantially as set forth.

In testimony whereof I have affixed my signature in presence of two witnesses.

HERBERT SCOTT.

Witnesses:
GEO. REVILL,
SAML. H. CRAVEN.