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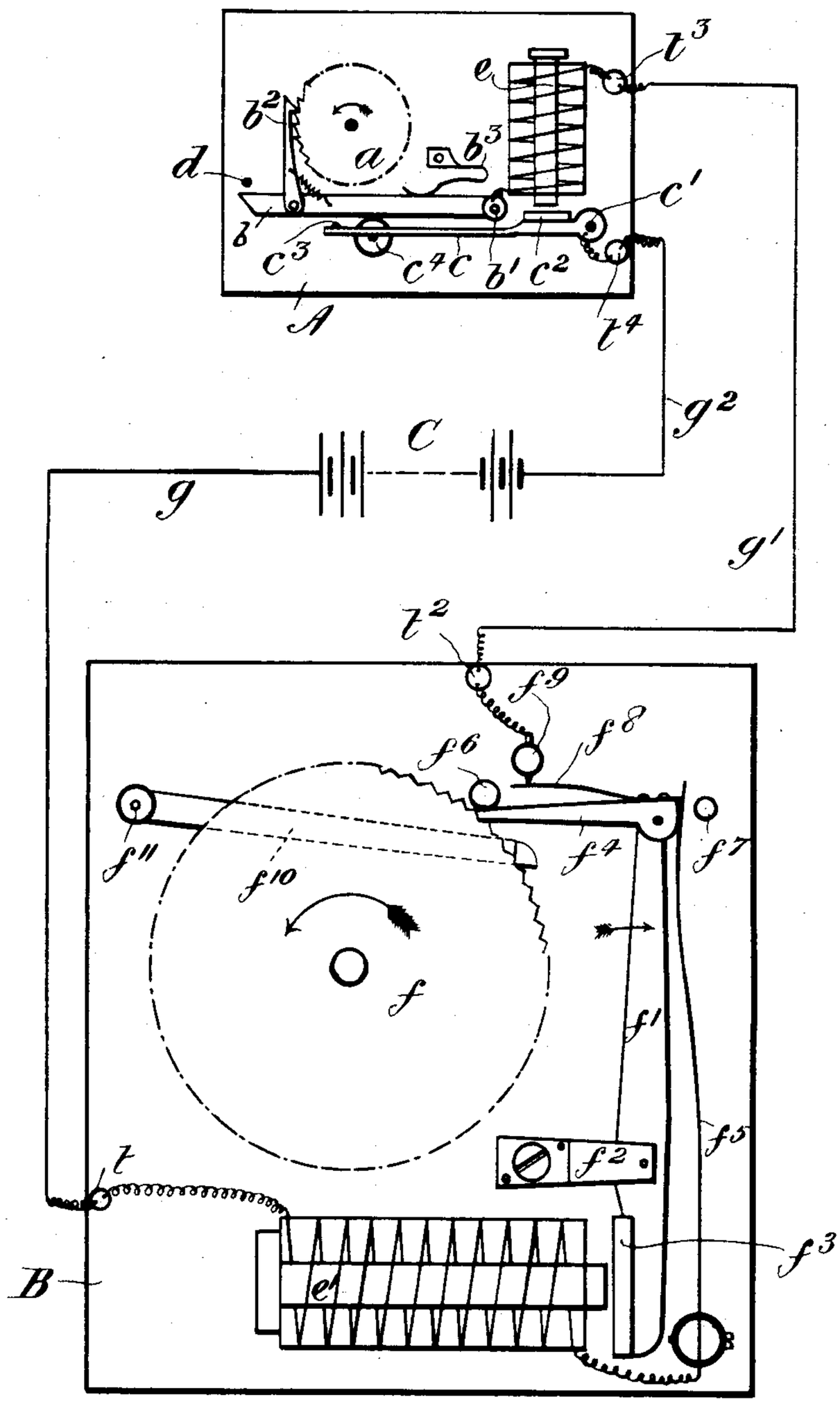
F. HOPE-JONES & G. B. BOWELL.

ELECTRIC CLOCK.

(Application filed Dec. 18, 1897.)

(No Model.)



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FRANK HOPE-JONES AND GEORGE BENNETT BOWELL, OF LONDON, ENGLAND.

ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 610,539, dated September 13, 1898.

Application filed December 18, 1897. Serial No. 662,451. (No model.)

To all whom it may concern:

Be it known that we, FRANK HOPE-JONES and GEORGE BENNETT BOWELL, electricians, subjects of the Queen of Great Britain, residing at 53 Victoria street, Westminster, London, England, have invented a certain new and useful Improvement in Systems for Electrically Regulating and Operating Clocks; and we do hereby declare that the following is a full, clear, and exact description of the same.

The invention relates to systems for electrically regulating and operating clocks wherein clock-movements are operated by electric currents controlled by an electrically-wound pendulum or regulator. Heretofore in systems of this description when the regulator has run down a circuit is made which rewinds same, the circuit being broken when the rewinding is accomplished. Under these conditions, however, it is possible for one or other of the controlled clock-movements to become inoperative without affecting the rewinding mechanism, which continues to make and break the circuit irrespective of the clock-movements. It therefore may happen that one of the clocks is no longer being synchronized by the regulator, owing to some failure in the clock-movement. Such failure, however, cannot be detected. According to the present invention these inconveniences are avoided by arranging that when the circuit has been made in the regulator mechanism it shall be first broken in the movement of one of the controlled clocks and not be made again until said clock has been operated. Consequently the next time that the regulator requires rewinding if said clock has not been operated a circuit can no longer be established, and the whole system is stopped until the clock-movement is put right.

In order that the invention may be clearly understood, we will now describe the same with reference to the accompanying drawing, which illustrates diagrammatically a system wherein a regulator A controls a clock-movement B, the battery or other source of electricity being indicated at C.

a is a ratchet-wheel the rotation of which is governed by any suitable escapement, such as an ordinary pendulum escapement, for example.

b is a lever pivoted at *b'* and provided with a click b^2, which engages with the teeth of the wheel *a*. Said lever is operated by a spring b^3, and through the click b^2 tends to rotate the wheel *a* in the direction of the arrow. Instead of the spring b^3 a weight may obviously be used to act upon the lever *b*.

c is a lever pivoted at *c'*, carrying the armature c^2 of an electromagnet *e*. Said lever also carries a contact c^3, adapted to connect with the lever *b*. The downward movement of lever *c* is limited by the stop c^4, and a stop *d* is provided for limiting the movement of the lever *b* in an upward direction.

Referring now to the movement shown at B, which is controlled by the regulator A, *f* is a wheel which may be in connection with the minute-hand of a clock or which is otherwise adapted to drive the remaining wheels of a clock-dial. Said wheel is provided with rectangular teeth, the faces of each tooth making angles of forty-five degrees with the radius of the wheel.

f' is a lever pivoted at f^2, carrying the armature f^3 of an electromagnet *e'*. Said lever is also provided with a click f^4, which engages with the teeth of the wheel *f*.

f^5 is a spring which operates to move the lever *f'* forward and so rotate the wheel *f* in the direction of the arrow. The movement of said lever is limited in one direction by the stop f^7 and in the other direction by the stop f^6, against which the click f^4 is pressed if the wheel *f* is rotated a certain distance.

f^8 is a spring mounted on the click f^4, which in the normal position of the lever *f'* and click makes contact with an insulated stud f^9.

To prevent the wheel *f* running back, we provide a retaining-click f^{10}, pivoted at f^{11} and adapted to engage with the teeth of the wheel, as shown.

The electric circuit is as follows: from the battery C through the wire *g* to insulated terminal *t* on the base of the secondary clock B, from terminal *t* through the electromagnet *e'*, spring f^5, click f^4, and spring f^8 to stud f^9, and thence to terminal t^2 through wire *g'* to insulated terminal t^3 on the base of the regulator A, from terminal t^3 through electromagnet *e*, lever *b*, and when lever *b* and contact c^3 are in connection through lever *c*, insulated

terminal t^4, and from said terminal through wire g^2 to the battery C. It must be observed that the stud c^4 and the pivot c' are insulated from the base of the regulator in order that the circuit may be broken when the lever b is raised out of contact with the point c^3.

The operation of the system is as follows: The lever b moves on its pivot under the influence of the spring b^3, and through the click b^2 rotates the wheel a in the direction of the arrow, the speed of rotation of said wheel being regulated by the escapement. As soon as the lever b reaches the contact c^3 the circuit is made and a current from the battery C, passing around the electromagnet e, energizes the same, and armature c^2 is attracted, thereby raising lever b to its topmost position, so that when the armature c^2 is released the lever b will be again in a position to operate the wheel a. It will be observed that during the rise of these two levers the contact-point c^3 rubs on the lever b and by this means is maintained clean and in condition to afford a good electrical contact. The making of the electric circuit also energizes the magnet e' in the clock-movement B, whereupon the armature f^3 is attracted and lever f' moves in the direction of the arrow against the force of the spring f^5, withdrawing the click f^4 from the teeth of the wheel f. As soon as this withdrawal is accomplished the click f^4 drops, so as to engage with the next tooth of the wheel f, and in so dropping breaks the connection between spring f^8 and contact-stud f^9. The armature c^2 in the regulator A and also the armature f^3 in the movement B are thereby released, and the levers c and f' return to their normal position. In doing so the lever c makes an additional break in the circuit—namely, between the lever b and contact c^3. The lever f, which moves forward under the influence of the spring f^5 as soon as its armature is released, rotates the wheel f in the direction of the arrow through the click f^4 until said click is brought into contact with the stop f^6, at which time the spring f^8 again makes contact with the stud f^9. No current will, however, flow around the circuit until the lever b has dropped sufficiently to again make contact with the point c^3. During the rotation of the wheel f the retaining-click f^{10} is raised and falls into the next tooth of the wheel.

It will be observed from the foregoing that the wheel f is rotated through the space of one tooth every time the lever b makes contact with the point c^3. The establishment of the circuit and consequent resetting of the lever b is, however, dependent upon the operation of the wheel f, since the spring f^8 will not connect with the stud f^9 unless the click f^4 has moved forward.

One or more clock-movements similar to that illustrated at B may be employed with the same regulator, the contacts of the clock-movements being connected in parallel and this grouping being in series with the regulator-contact, though in some cases it may be more convenient to provide the break on one movement only.

An important advantage which we obtain with our improved system is that the circuit is maintained while the work is being performed, but is cut off the moment the work is done. Hence the duration of contact is always sufficient to insure the proper operation of the clock-movement and at the same time is not unnecessarily prolonged.

The form of the teeth of the wheel f—namely, with straight faces making an angle of forty-five degrees with the radius—taken in conjunction with the position of the click f^4, which is also normally at forty-five degrees to the radius, is important inasmuch as the click moves straight out of engagement with the wheel-teeth, and consequently will be operated very readily, so that a very short duration of contact between the lever b and point c^3 will cause the operation of the clock-movement B. In a movement of this description as ordinarily constructed the click f^4 is approximately tangential to the wheel f, and the stop f^6 being located immediately above the said click the smallest eccentricity in the wheel f would cause the click to bind between the wheel and the stop, and thereby interfere with the operation. This does not occur with our improved device.

What we claim is—

1. The combination of an electrically-wound regulator, a secondary clock the hands of which are moved through the agency of an electric current, means in the regulator for making the electric circuit which operates the secondary clock, and means in the secondary clock for opening said circuit.

2. The combination of an electrically-wound regulator, a secondary clock the hands of which are moved through the agency of an electric current, means in the regulator for making the electric circuit which rewinds the regulator and at the same time operates the secondary clock, and means in the secondary clock for breaking said circuit.

3. The combination of an electrically-wound regulator, a secondary clock the hands of which are moved through the agency of an electric current, means in the regulator for making the electric circuit which operates the secondary clock, and means in the secondary clock whereby said circuit is broken during the operation of the secondary clock and made, when, but not until, said operation is completed.

4. The combination of an electrically-wound regulator, a secondary clock the hands of which are moved through the agency of an electric current, two levers in said regulator forming part of the electric controlling-circuit, said levers being adapted to make the circuit when the regulator has run down and remaining in connection until said circuit has been broken at another place, and means in the secondary clock for breaking the circuit.

5. In an electrically-controlled clock-movement the combination of a toothed wheel *f*, a click f^4 operating said wheel, an electromagnet which when energized causes said click to be withdrawn from engagement with said wheel, a contact-spring on said click, and an electric contact coöperating with said contact-spring to break the circuit through the operating-magnet when the click is withdrawn from the wheel as set forth.

6. In an electrically-controlled clock-movement the combination of a toothed wheel *f*, a click f^4 operating said wheel, a lever on which said click is pivoted, a spring acting on said lever, and an electromagnet which when energized moves said lever in opposition to its controlling-spring, and thereby causes said click to be withdrawn from engagement with the wheel, as set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

FRANK HOPE-JONES.
GEORGE BENNETT BOWELL.

Witnesses:
FREDERICK WILLIAM LE TALL,
LEONARD EDMUND HAYNES.