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PROVISIONAL SPECIFICATION.

Improvements in Electrically Driven Clocks and other Electrically Driven Running Mechanisms.

We, ROBERT MANN LOWNE, of No. 108, Bromley Road, Catford, in the County of Kent, Scientific Instrument Maker, and THE LOWNE ELECTRIC CLOCK & APPLIANCES COMPANY, LIMITED, of the same address, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in electrically driven clocks and other electrically driven running mechanisms.

One important feature of the present invention consists in an improved method of connecting the electrically operated urging device to the mechanism to be driven, such as, for example, the escapement mechanism of a clock.

Another important feature of this invention consists in special means for silencing the movements of the mechanism which occur on the making and breaking of the electric circuit.

Referring to the first mentioned feature, a terminal of an electric circuit undergoes continuous movement, by the escapement or other operated mechanism, towards another terminal, which latter, when contact is made, recedes from the former to be again approached, and so on successively, and, on the recess of the second mentioned terminal, a medium for urging the escapement or other mechanism, interposed between the carriers of the two terminals, receives an access of energy.

Such a mechanism may be arranged and operated as follows:—

A spindle of the escapement or other mechanism is angularly advanced by the strain of a spring which, at intervals is subjected to an increase of strain through the medium of an electro-magnet, the strain of the spring undergoing gradual reduction by the movement of the driven mechanism.

Before the strain of the spring has been eliminated, an electric circuit, which includes the winding of the said electro-magnet, is completed by the approach of one terminal carried by the driving spindle of the escapement or other mechanism towards another terminal carried by an electrically urged spindle.

On the completion of the circuit, the armature of the electro magnet is displaced in opposition to the strain of a spring or gravity, the first effect of the displacement being the breaking of the electric circuit, permitting the spring to immediately cause the recess of the armature from the pole or poles of the magnet and again complete the circuit.

The recess of the armature under the pull of the spring causes the electrically urged spindle before mentioned to be advanced a step and, whilst renewing the strain of the spring which drives the escapement or other mechanism, also breaks the electric circuit by separating the terminal carried by the electrically urged spindle from the terminal which is carried by the spindle of the escapement or other mechanism.

By such means the former terminal is caused to intermittently recede from

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the latter, which steadily reapproaches and momentarily resumes contact, the operation occurring periodically. Accordingly the circuit is repeatedly broken by the separation of a pair of terminals and, after the resumption of contact, the circuit is broken by the separation of a second pair of contacts which are again united prior to the separation of the first mentioned pair of terminals.

The separation of the second pair of contacts may under some circumstances be dispensed with but, by duplicate circuit-breaking as above described, precision in the operation of the armature will be rendered more certain.

The above described operation can be conveniently performed by mounting the said two spindles in the same straight line and securing to each a cross-arm.

To one end of each cross-arm the said two terminals are so secured as to pursue the same circular path and at the other end of one of the arms the driving spring is secured whilst on the second arm there is a projection adapted to engage with the spring.

A ratchet wheel is secured to the electrically urged spindle and this is advanced by a pawl on the recess of the armature.

Alternatively to employing the second pair of contacts, as above described, the ratchet wheel may be advanced in two steps, one occurring when the armature is just completing its approach to the poles of the magnet and thus causing the above described terminals to be separated, the second step, whereby the increase of strain of the driving spring is completed, taking place during the recess of the armature.

The driving device above described may be employed in maintaining in movement any running mechanism which does not include an escapement, as for example that employed in the striking operation of a clock.

The silent operation of the mechanism is effected by the following devices:—

The armature, instead of being so mounted as to directly approach and recede from the poles of the electro-magnet, is so pivotally mounted as to be capable of being angularly displaced in a plane at right angles to the axis of the magnet.

If the magnet is of the horse-shoe form, or the equivalent thereof, the axis of angular reciprocation of the armature is situated midway between the axes of the two branches of the magnet and the length of the armature is normally retained by a spring inclined to the line joining the two poles of the magnet.

When the magnet is energized, the armature is attracted into a direction parallel to the line joining the two poles of the magnet, contact of armature and magnet being avoided.

The armature is arrested, on approaching the position in which it is in the line parallel to that joining the poles, by a spring and this latter can advantageously constitute a portion of the electric circuit, its extremity being one of the before mentioned second pair of contacts.

In arresting the swing of the armature the two contacts are momentarily separated and the circuit temporarily broken although the first pair of terminals are, at that time, in contact with each other.

The other extremity of the swing of the armature may be determined by a cushioning buffer or by the operation of the before mentioned withdrawing spring.

To still or eliminate vibration the armature spindle has a balanced mass mounted thereon and so frictionally connected thereto as to permit of lost motion by the inertia of the mass at the two extremities of the swing of the armature.

The silencing contrivance comprises also means for effecting a cushioned impact of the pawl against the teeth of the ratchet-wheel. Those means include such a formation of pawl that it elastically yields to the force it transmits, and in engaging with the tooth it rides over one spring which, in the receding movement, prevents it from dropping with a noisy contact on the next succeeding tooth and presses against a second spring on the opposite side of the pawl, the pawl being guided between the two springs into silent engagement with the tooth of the ratchet-wheel.

In clocks which are electrically operated under the command of a master clock, the above described mechanism may be employed with a modification of the electric circuit which is so arranged that the approach of the armature completes a shunt circuit in parallel with the winding of the electro-magnet and helps in silencing the action of the mechanism by minimizing the induction.

Dated this 23rd day of November, 1910.

PHILLIPS & LEIGH,
Agents for the Applicant.

COMPLETE SPECIFICATION.

Improvements in Electrically Driven Clocks and other Electrically Driven Running Mechanisms.

We, ROBERT MANN LOWNE, of No. 108, Bromley Road, Catford, in the County of Kent; Scientific Instrument Maker, and THE LOWNE ELECTRIC CLOCK & APPLIANCES COMPANY, LIMITED, of the same address, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in electrically driven clocks and other electrically driven running mechanisms.

The principal feature of the present invention resides in the means adopted for abstracting a portion of the mechanical energy, rendered available on the intermittent completion of an electric circuit through the winding of an electro-magnet, and employing such abstracted energy to effect a repetition of the intermittent completion of the electric circuit, the remainder of the energy rendered available by the energizing of the electric circuit being employed in urging the hands of a clock, the striking mechanism of a clock or other running mechanism.

Another important feature of this invention resides in the special means which are employed to silence the intermittent action of the mechanism of an electric clock.

The means employed, in achieving the object first mentioned, comprise two insulated rotating elements which are so mounted that portions thereof move approximately along the same circular path, one, called the "pursued" element, being caused to intermittently advance and separate itself from the other element called the "pursuer", the latter, by the effort rendered available on effecting the separation being endowed with sufficient energy to enable it to continue the pursuit, the overtaking of the pursued element causing the energization of an electro-magnet and the forced displacement of the armature thereof, thus providing the requisite energy to drive the running mechanism and reinstate sufficient energy in the pursuer to enable it to continue its pursuit and repeat the operation of drawing on the source of electrical energy to continue the performance.

Specific embodiments of this portion of the invention and also of the silencing devices will be described by reference to the accompanying drawing in which:—

Fig. 1 shows diagrammatically a plan of a construction embodying the first mentioned "driving" feature of this invention.

Fig. 2 shows, in elevation, a portion of the mechanism of Fig. 1.

Fig. 3 is a plan view showing an arrangement which is alternative to a portion of Fig. 1.

Fig. 4 is a plan view of a portion of an electric clock which embodies the "silencing" features in addition to the "driving" device.

Fig. 5 being a sectional elevation of the mechanism taken along the line 5—5 of Fig. 4.

Referring first to Figs. 1 and 2, A is the before mentioned pursued element and B the pursuer. These two elements are co-axially mounted, one on spindle a and the other on spindle b and are normally insulated from each other. The element A comprises a ratchet-wheel a^1 to which is secured a post carrying an electric terminal a^2 and on the opposite side of the axis of A an insulated push-piece a^3. To the spindle of the pursuing element B an arm b^1 is secured which carries an electric terminal b^2 and a spring b^3 fixed to the arm at one end and adapted to be bent away from the arm at the other end. The element A is connected to the parts to be driven, as for example the hands of a turret or other clock, the striking mechanism of a clock or other mechanism to which an urging force is required to be applied. The element B is, for most purposes, connected to a mechanism whereby it is constrained from an instantaneous overtaking of A, as for example by an escapement contrivance or by the vane device which controls the rate of movement of the striking mechanism of a clock or alternatively by a fly-wheel. These mechanisms are not shown on the drawing.

For the purpose of operating the above described mechanism a source of electrical energy is provided, indicated by a battery c, an electro-magnet d and a pivoted armature e. This latter carries a pawl e^1 adapted to engage with the teeth of the before-mentioned ratchet-wheel a^1 and a spring e^2 adapted to serve as a terminal or contact maker and breaker with a terminal f which is secured to the frame-plate of the machine. A spring g is also provided whereby the armature is withdrawn from the poles of the electro-magnet, when the latter is de-energized.

The electric circuit, when complete, is along the lead h^1, the winding of the electro-magnet, the lead h^2, the spindle b, arm b^1 and when b^2 and a^2 are in contact, through the ratchet-wheel a^1, its spindle a, the lead h^3 to the armature e and spring e^2 and, when the latter is in contact with the terminal f, the circuit is completed back to the second pole of the battery c by the lead h^4.

When the circuit is thus closed the electro-magnet will be energized and attract the armature e. The consequent angular displacement of e will, before it is completed, cause the separation of the spring e^2 from the terminal and break the circuit, permitting the spring g to withdraw the armature from the electro-magnet and, through the medium of the pawl e^1, force the ratchet-wheel a^1 through a small angle. In this manner an effort will be rendered available to drive the mechanism connected to A. In the resulting movement of the ratchet-wheel the terminal b^2 will be left behind by the terminal a^2 and cause a gap in the electric circuit.

The angular displacement of the ratchet-wheel, relatively to the arm b^1, will also cause the spring b^3 to be bent away from the arm by the push-piece a^3. The push-piece a^3 will now serve as an abutment for the spring b^3 and enable it to apply a rotative effort to the element B and cause its terminal b^2 to presently overtake the terminal a^2 and re-close the electric circuit and so repeat the performance.

I have found that the above described operation is not absolutely dependent on the breaking of the circuit between e^2 and f, for the recoil of the armature, at the termination of its inward swing, will ordinarily cause the breaking of the circuit between b^2 and a^2, but it will in general be advantageous to provide the additional break in the electric circuit as described.

In Fig. 3, a device is shown whereby, on the completion of the approach of the armature towards the electro-magnet, the circuit is positively broken between the pursued and pursuing elements, the urging force for driving the mechanism connected to the pursued element and the re-instatement in the pursuer of the necessary energy to maintain the pursuit being derived during the spring-operated withdrawal of the armature as in Fig. 1.

In Fig. 3 parts which correspond with Fig. 1 are similarly lettered. The tail of the pivoted armature c carries a roller c^3 which on the approach of the armature towards the electro-magnet engages with a lever k pivoted at k^0 and carrying a click k^1 which engages with the teeth of the ratchet-wheel a^1 in a manner similar to the engagement of the pawl c^1 which is carried by the armature.

With such a mechanism, the approach of the armature towards the electro-magnet will cause the click k^1 to sufficiently advance the ratchet-wheel a^1 to separate the terminals of the pursued and pursuing elements, thus ensuring the return of the armature by the spring g, during which return the pawl c^1 will complete the advance of the ratchet-wheel and re-instate the energy in the spring which is required to urge the pursuing element B.

Figs. 4 & 5 show the portions of an electrically-driven clock which are relevant to the present invention. These comprise, with a modified form of construction of some details, the "driving" feature of this invention and combined therewith the silencing devices. The parts which correspond with those of Figs. 1 & 2 are similarly lettered and the above description will to a considerable extent apply to the construction shown in Figs. 4 & 5.

Instead of the electro-magnet d being so pivoted as to approach and recede from the electro-magnet in the direction of the axis of the magnet the armature m is, in a known manner, secured to a spindle m^1 the axis of which is parallel to the axis of the electro-magnet, the armature being so constrained, when withdrawn by the spring n, that its centre line takes a position which is approximately at an angle of 45° with the line which joins the two poles of the electro-magnet d.

On the completion of the electric-circuit and energization of the electro-magnet, the armature will be angularly displaced by the magnetic force in the direction towards the line which joins the two poles of the magnet. In this movement an arm secured to the spindle m^1 and provided with a pin m^2 to which is connected the pawl o, is so angularly displaced as to withdraw the pawl from the ratchet-wheel sufficiently to enable it to engage with the next tooth, the tension of the spring n, which is secured to the pawl, being thereby increased and serving, when the electric-circuit is broken, to return the armature to its normal position and provide the force necessary to urge the ratchet-wheel and the mechanisms connected therewith, including the terminal a^2 and the push-piece a^3 which are carried on an arm a^4 secured to the spindle a of the pursued element.

The pursuing element comprises a balance-wheel escapement mechanism contained in the case p, shown in Fig. 5 but omitted from Fig. 4. This mechanism may be of watch-like dimensions as its only duty is to rotate the arm b^1 of the pursuing element under the influence of the slight strain of the bent spring b^3, and yet this feeble mechanism is able to invoke a considerable relay effort to drive a turret clock for example.

The breaking of the electric circuit, which corresponds to the action of the spring c^2 of Fig. 1, is effected as follows:—

The extremity of a spring q carried by a post q^1, insulated from the frame-plate r, is normally in contact with another spring s carried by the post s^1 which is in electrical connection with the frame-plate. When the electro-magnet is energized, a pin t, carried on an arm secured to the spindle m^1 of the armature, presses on the lower spring s and separates its extremity from that of the spring q and permits the armature to return to its normal position under the action of the spring n.

The electric circuit from and to the battery c, when complete, is provided by the following sequence of elements:—The lead h^1, winding of electro-magnet d, lead h^2, case p, spindle b of pursuing element, arm b^1, terminals b^2 a^2 when in contact, arm a^4, frame-plate r, post s^1, spring s, spring q, post q^1 and leads h^3 and h^4.

With such a construction, as above described, the only cause whereby an audible sound could be produced is that which occurs on the contact of the pawl *o* and the click *u* with the teeth of the ratchet-wheel. To eliminate or minimize sounds from such a cause, the extremities of the pawl and click are provided with cushioning springs. The pawl *o* may be formed with a bow o^1 permitting the extremity to yield relatively to the body of the pawl. Also, at the back of the extremity of the pawl, a spring o^2 is provided which deadens the contact of the pawl with the limiting abutment *v* on the completion of the spring-operated return swing of the armature. To prevent the pawl, on its withdrawal from the ratchet-wheel, from making a noisy contact with the succeeding tooth of the ratchet-wheel, another spring o^3 is interposed between the pawl *o* and the click *u* and this spring may be carried by the pawl as shown in the drawing or, alternatively, it may be carried by the click *u* or by the frame-plate *r*. By the use of this spring, the pawl *o* will ride off one tooth of the ratchet-wheel into silent engagement with the next tooth. In order that the click *u* may drop from one tooth into silent engagement with the next, it also is furnished with a spring u^1, u^2 being a spring which maintains the click in contact with the ratchet-wheel.

In Fig. 4 is shown a disc *w* mounted on the spindle m^1 of the armature and frictionally connected thereto by a spring w^1. By the aid of this device, abruptness in the movement of the armature is lessened with advantage in respect to increased silence in the action of the mechanism.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In electrically-driven clocks or other electrically-driven running mechanisms, in which electric energy, rendered available on the intermittent completion of an electric-circuit through the winding of an electro-magnet, is employed in maintaining in motion the said clock or other mechanism, a contrivance wherein two rotating elements, normally insulated from each other, are so mounted that portions thereof move approximately along the same path, one, called the "pursued" element, being caused to intermittently recede from the other, called the "pursuer", by the energizing of the electro-magnet and effect a temporary gap in the energizing circuit, a spring carried on the pursuing element receiving at the same time an increase of strain, the spring-carrying pursuing element being, by the increase of energy temporarily stored in the strained spring, urged to overtake the pursued element, re-close the electric-circuit and re-energize the electro-magnet, and so on successively.

2. In a contrivance according to Claim 1, an arrangement wherein on the approach of a pivoted armature towards the energized electro-magnet the electric circuit is broken by the separation of the terminals carried by the said pursued and pursuing elements.

3. In a contrivance according to Claim 1, an arrangement wherein, on the approach of a pivoted armature towards the energized electro-magnet, a second gap is formed in the electric circuit and, on the recess of the armature, this second gap is closed.

4. A form of construction according to Claim 1, in which the pursuing and pursued elements are co-axially mounted, the former carrying a spring and an electric-terminal, the latter, a push-piece and a second electric-terminal so arranged that the two terminals move in the same circular path and, when they are separated, the spring is bent by the push-piece, which latter serves as an abutment for the bent spring causing it to urge the pursuing element to resume contact with the pursued.

5. In clocks or other running mechanisms electrically driven according to either of the preceding claims, a pawl or a click provided with a cushioning

spring at its extremity to promote silent engagement with the teeth of a ratchet-wheel or limiting abutment.

6. Electrically driven clocks and other mechanisms constructed substantially as described with reference to the accompanying drawing.

Dated this 23rd day of May, 1911.

PHILLIPS & LEIGH,
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A.D. 1910. Nov. 23. N° 27,293.
LOWNE & *others'* COMPLETE SPECIFICATION.

(1 SHEET)

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

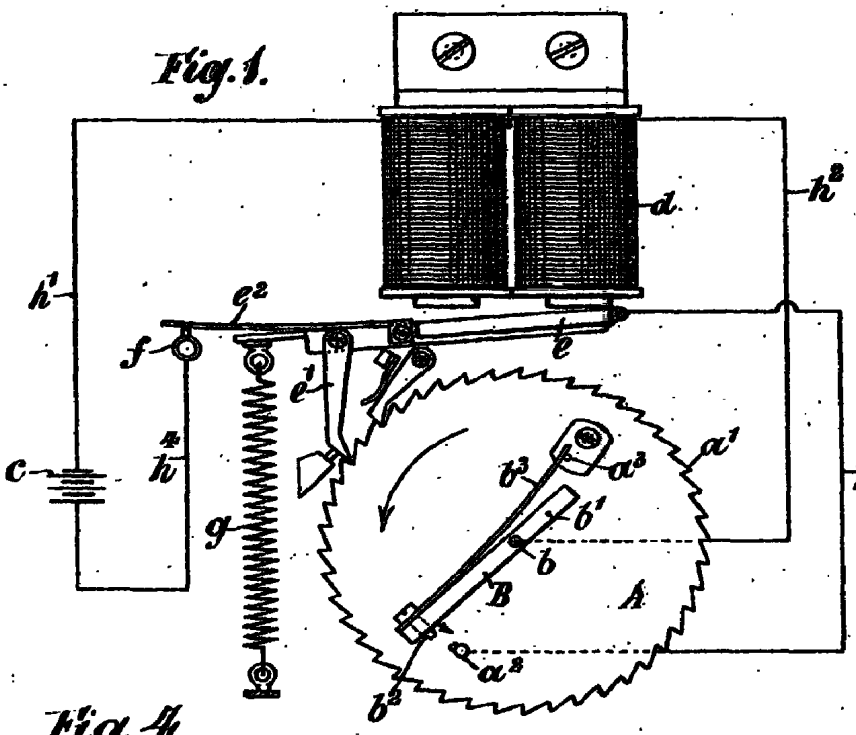


Fig. 2.

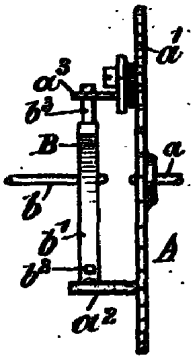


Fig. 4.

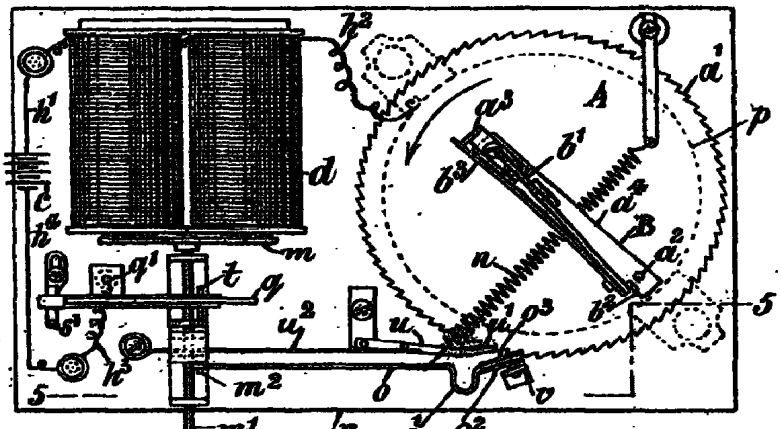


Fig. 3.

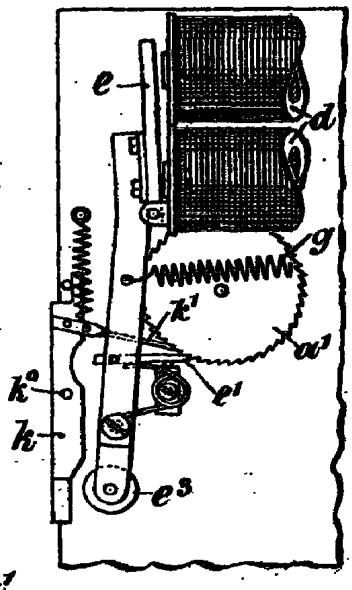
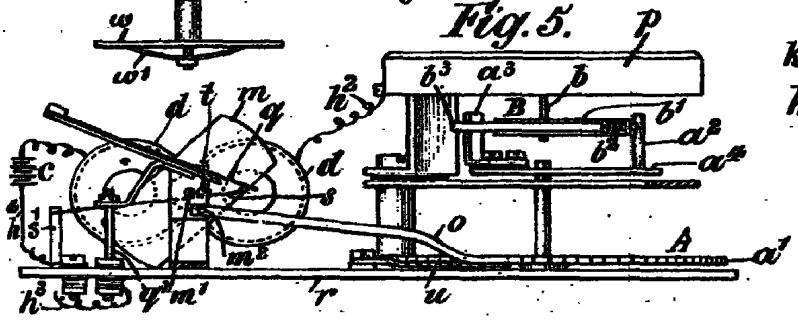


Fig. 5.



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