(No Model.)

3 Sheets—Sheet 1.

D. & G. VANDE PLANCKE.

ELECTRIC REGULATING CLOCK.

No. 446,801. Patented Feb. 17, 1891.

FIG. 1.

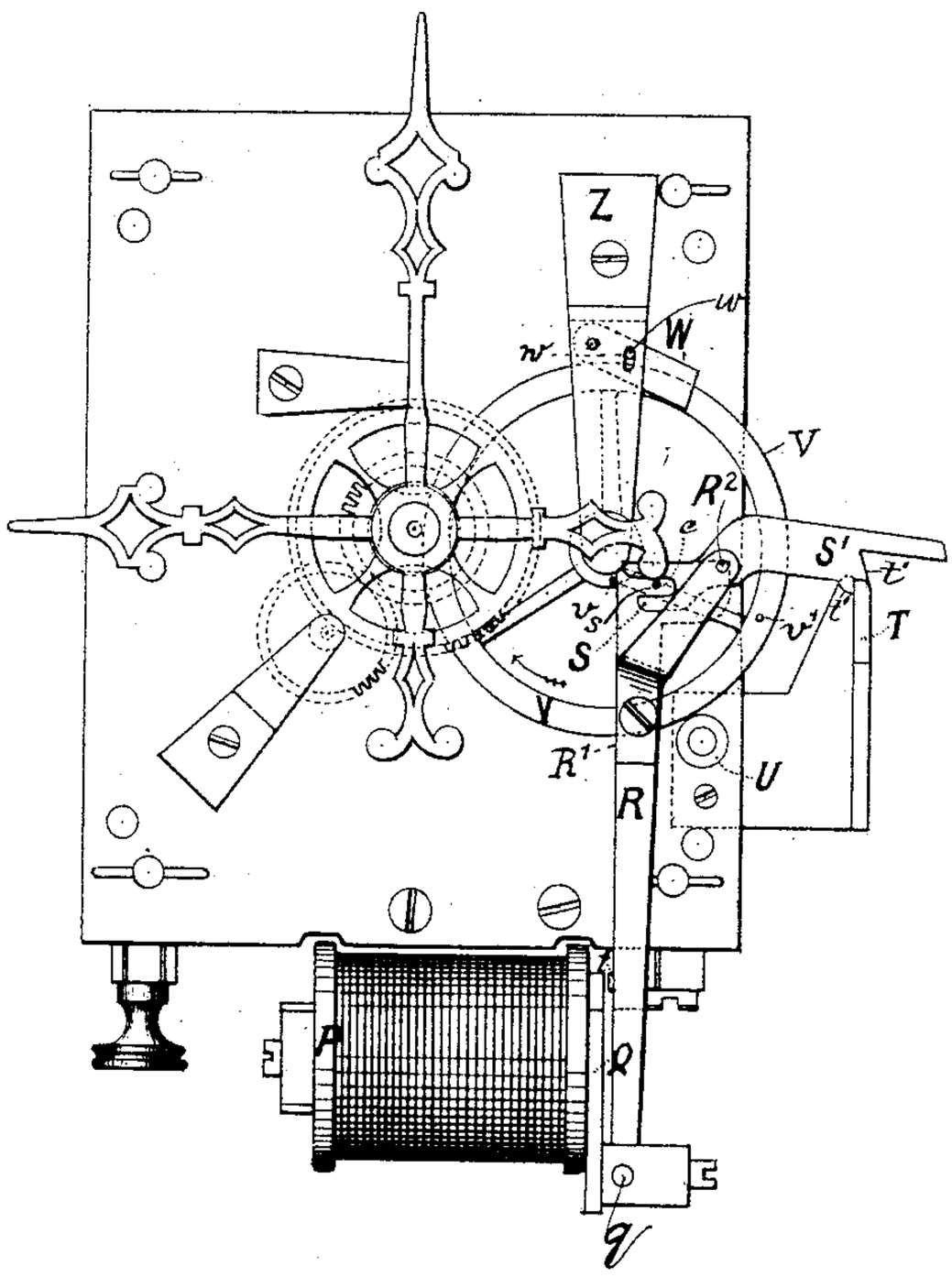
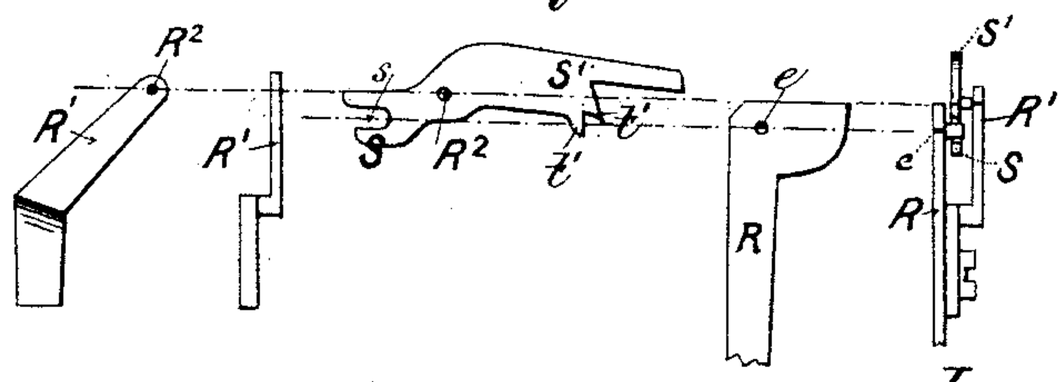


FIG. 2.



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(No Model.)

3 Sheets—Sheet 2.

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FIG. 3.

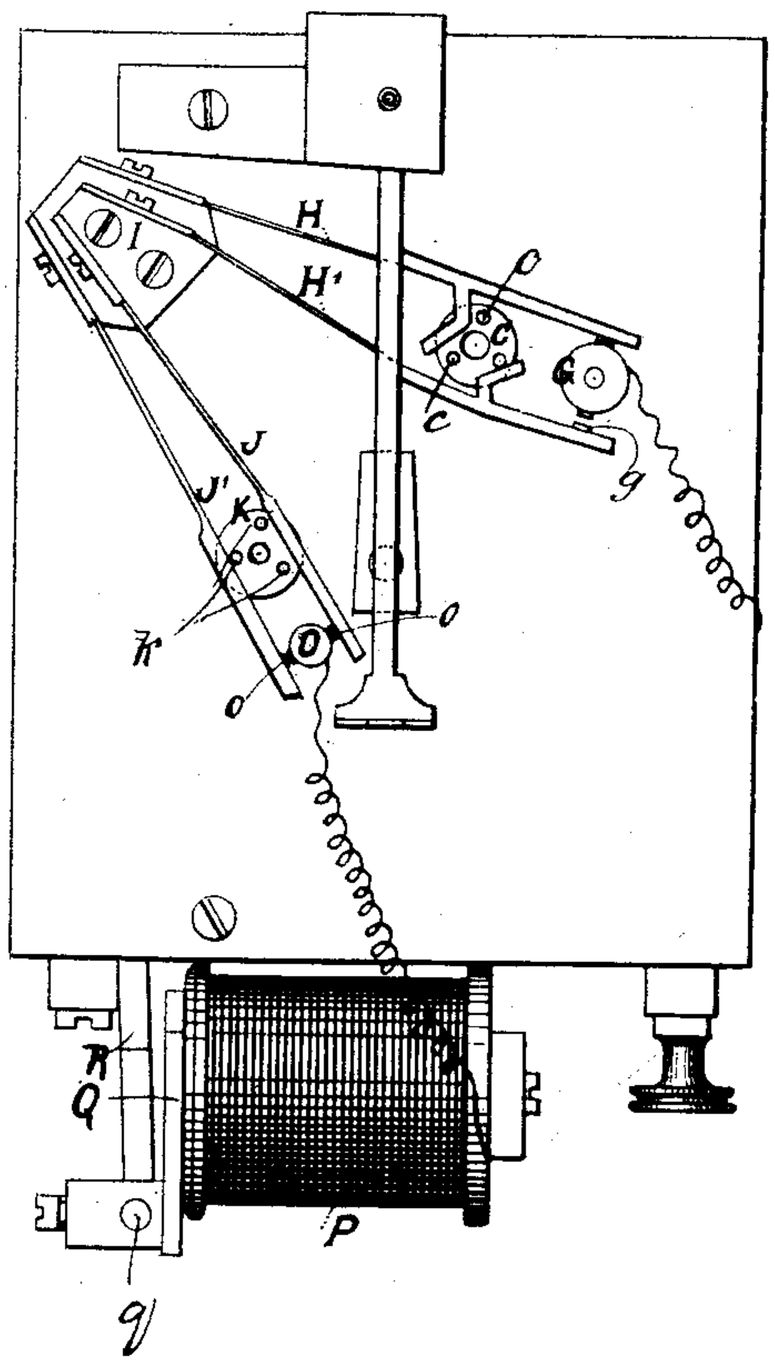

FIG. 4.

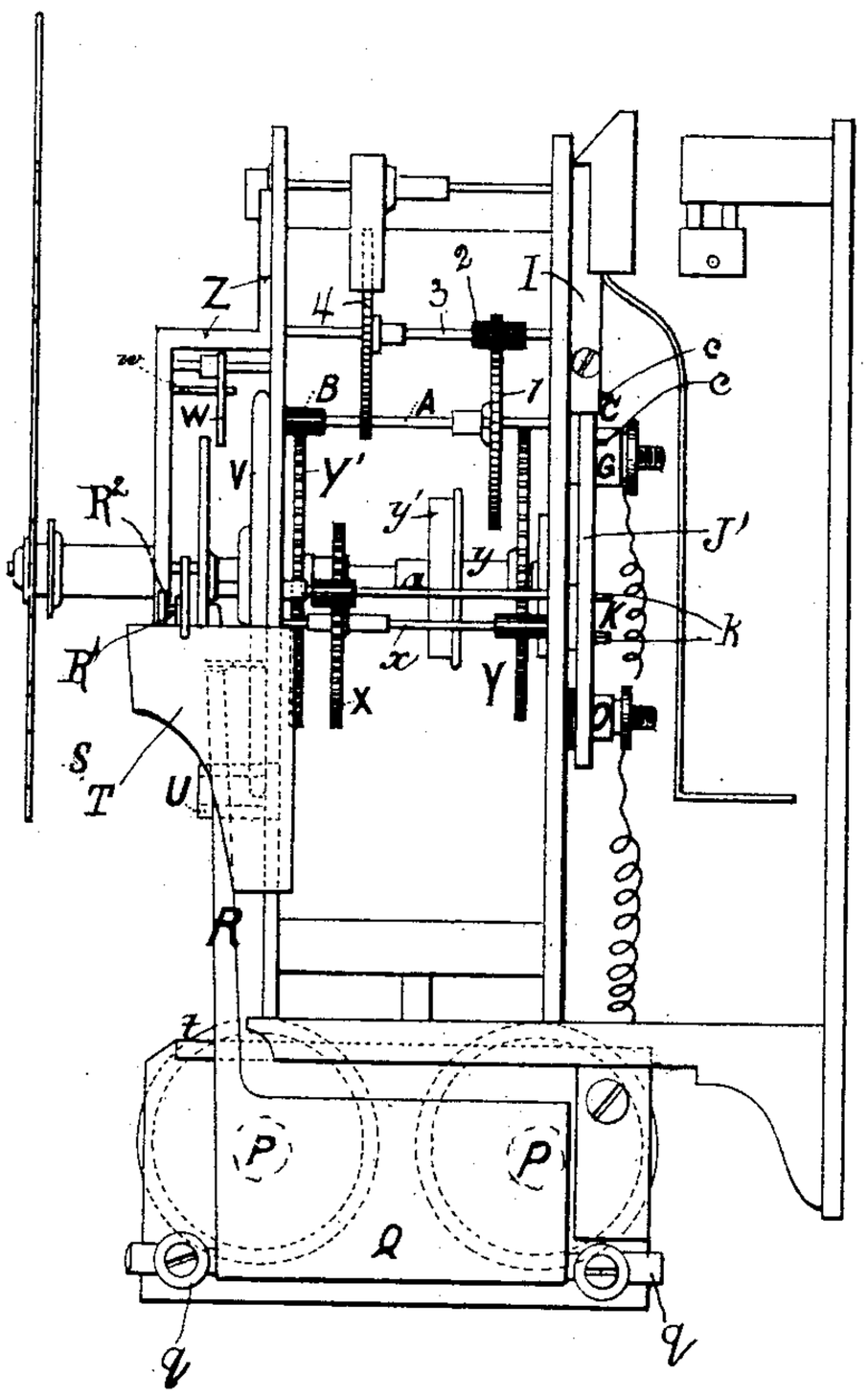

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FIG. 5.

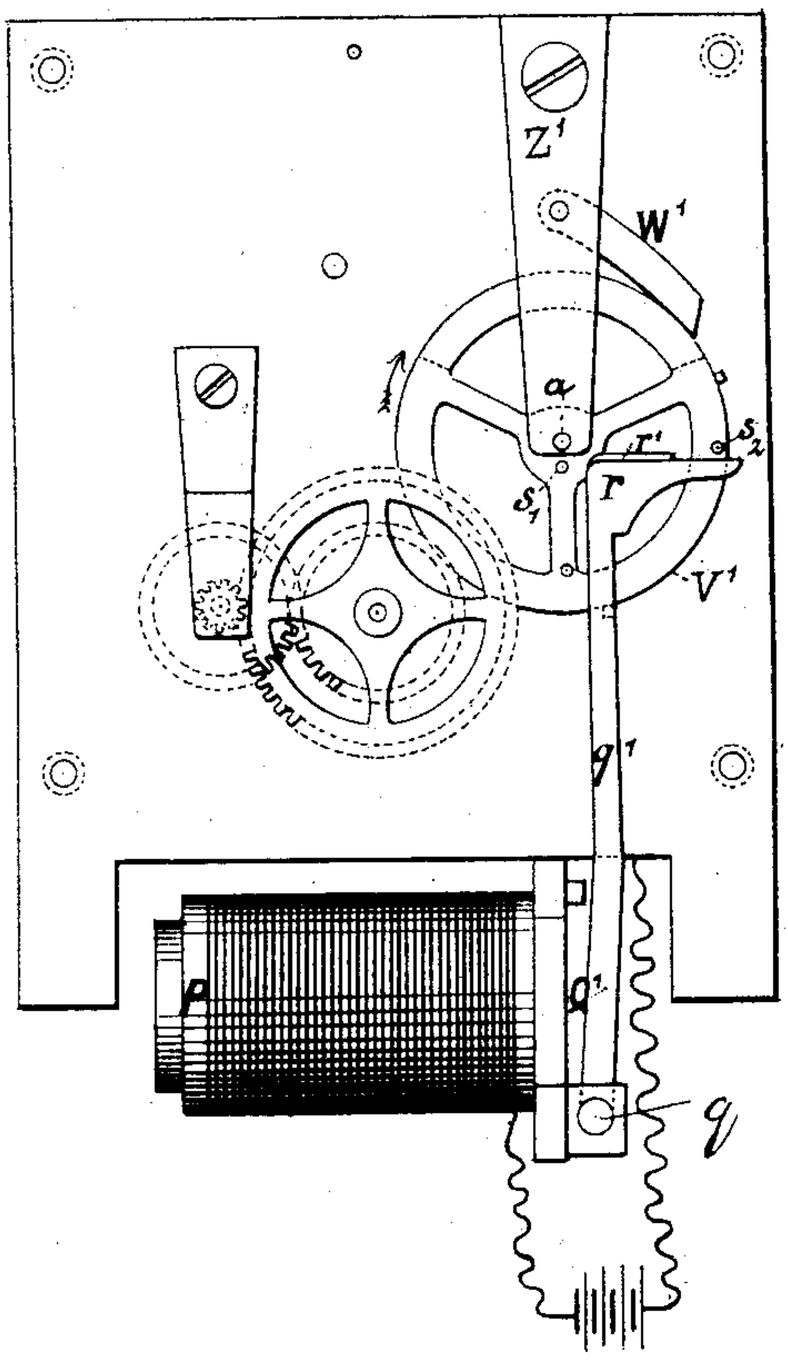


FIG. 6.

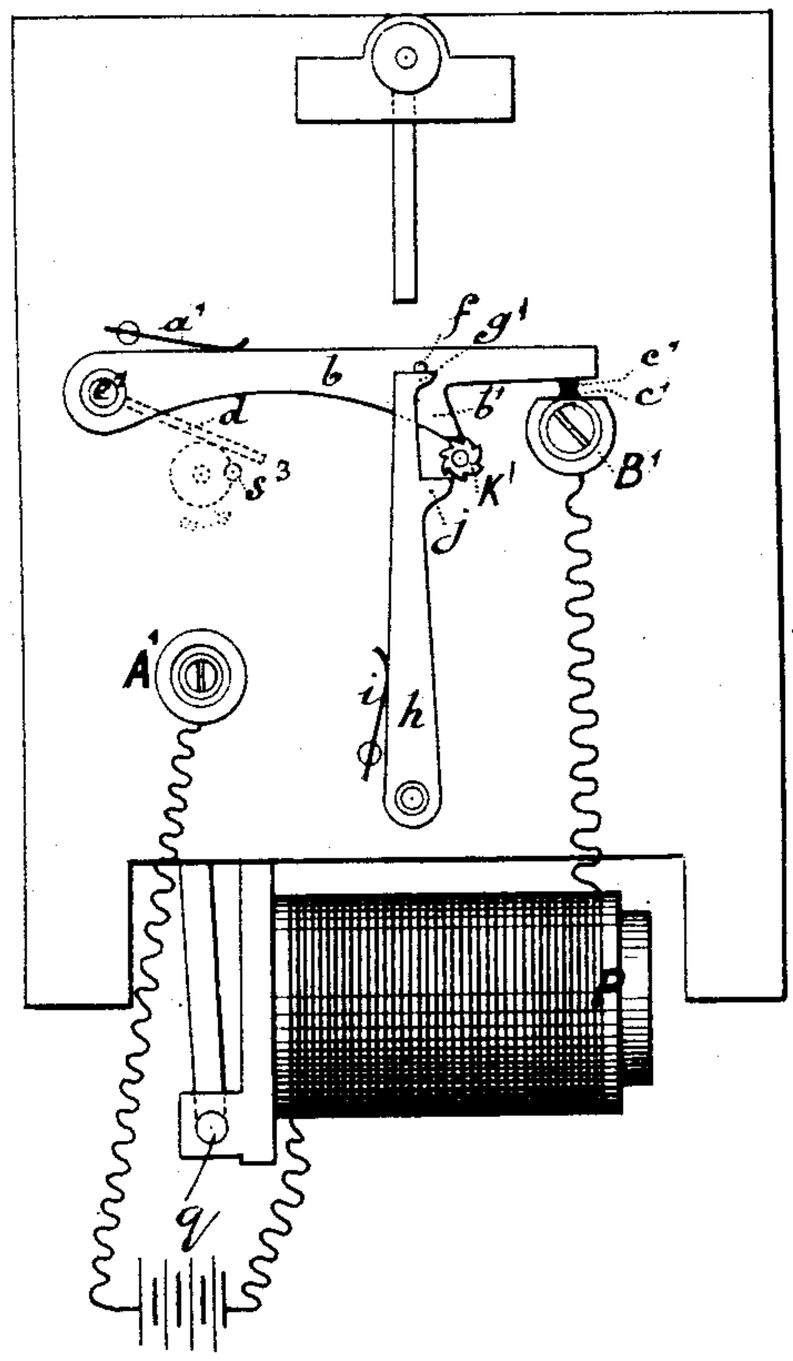
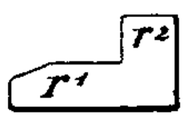


FIG. 7.



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UNITED STATES PATENT OFFICE.

DÉSIRÉ VANDE PLANCKE AND GUSTAVE VANDE PLANCKE, OF COURTRAI, BELGIUM.

ELECTRIC REGULATING-CLOCK.

SPECIFICATION forming part of Letters Patent No. 446,801, dated February 17, 1891.

Application filed May 21, 1889. Serial No. 311,586. (No model.) Patented in Belgium February 4, 1885, No. 67,750; in Germany April 13, 1885, No. 34,064; in France June 29, 1885, No. 169,834, and in England July 14, 1885, No. 8,538.

To all whom it may concern:

Be it known that we, DÉSIRÉ VANDE PLANCKE and GUSTAVE VANDE PLANCKE, subjects of the King of Belgium, and residents of Courtrai, Belgium, have invented certain new and useful Improvements in Electric Clocks, (which have been patented to us in Belgium by Letters Patent No. 67,750, dated February 4, 1885, and patent of Improvement No. 84,814, dated January 29, 1887; in Germany by Letters Patent No. 34,064, dated April 13, 1885; in France by Letters Patent No. 169,834, dated June 29, 1885, and certificate of addition dated February 20, 1889, and in Great Britain by Letters Patent No. 8,538, dated July 14, 1885,) of which the following is a full, clear, and exact specification.

Our invention consists in a new system of electric regulating-clocks in which the instantaneous closing and breaking of the electric circuit has the double effect of sending intermittent currents to different receiving-dials and at the same time winding the regulator itself. The circuit of the electro-magnet, which is periodically opened and closed by the movement of the clock, may include one or more electro-magnets belonging to one or more secondary clocks. The latter may be constructed in the usual manner, or like the clock described in English Patent No. 8,538, dated July 14, 1885. This latter result may be obtained with any kind of clock provided with our improvements, so that our invention may serve equally well for assuring the continuous and permanent running of ordinary clocks and for transmitting the time to distant points.

Our regulator is composed of an ordinary clock mechanism, with the addition of the following parts: first, the circuit of a galvanic battery including or controlling the coils of an electro-magnet, and an appliance connected with the seconds-motion shaft of the going-work and constructed in such a manner as to close the said circuit at short intervals—for instance, every minute or every half-minute; second, a fly-wheel mechanism, chiefly comprising a lever fixed to the armature of the said electro-magnet and an unequally-weighted fly-wheel adapted to receive at each contact impulses from the said lever sufficient to make an entire revolution every time, the whole serving, first, to wind the spring or the weight-motor of such a quantity as to enable the clock to work at least until the following contact takes place, and, secondly, to interrupt the said electric circuit almost immediately after it has been closed, thus avoiding polarization and insuring the long duration of the battery which feeds the circuit.

Our invention may therefore be divided into two distinct parts, as follows: first, the appliances for forming contacts, and, second, the appliances for breaking contacts and at the same time winding up the clock-work. In each of these classes we have been lead to adopt successively various arrangements of detail, which have been gradually simplified.

We will describe two varieties in order to show more clearly in what our invention essentially consists, and also in what manner the details of construction may vary without departing from the principle of our invention.

We will first describe what relates to the periodical formation of contacts or closing of circuits.

In the accompanying drawings, Figure 1 is a front elevation of mechanism embodying our invention and showing an appliance for breaking contact and for the automatic winding. Fig. 2 is a detail view showing parts of the mechanism seen in Fig. 1. Fig. 3 is a rear elevation representing the first means of making contacts or the first arrangement of detail. Fig. 4 is a side elevation. Fig. 5 is a front elevation showing another means for forming contacts. Fig. 6 is a rear elevation thereof. Fig. 7 is a plan view of the brake-spring.

Referring to Figs. 3 and 4, on the axle A of pinion B is fixed a cylinder C, of ivory or other insulating material, provided with steel pins *c*, the number of which depends upon the division of the wheels of the clock. These pins are in contact, one after the other, with two springs H and H′, extending beyond the cylinder and carrying at their ends contact-pieces *g*, of platinum, placed opposite corresponding platinum pieces secured in opposite sides of the terminal G, which is insulated

from the metallic clock-frame and connected with the pole of a battery. The said springs H and H′ are attached at the other end to a piece I, of insulating material, and communicate with two other springs J and J′, which come in contact, one after the other, with the steel pins of a second cylinder K, likewise of insulating material, and armed with as many steel pins *k* as the cylinder C. These springs J and J′ extend beyond the cylinder K and carry at their extremities contact-pieces *o*, of platinum, placed opposite two corresponding contact-pieces, which are fixed in the terminal O, insulated from the clock-frame, but connected with the coil of the electro-magnet P, the other extremity of the magnet-coil leading directly to the battery. In consequence of this arrangement the circuit is complete when a spring H or H′ rests on the terminal G, and at the same time a corresponding spring J or J′ rests on the terminal O. This coincidence depends on the division of the clock-wheels and may occur, for instance, at the beginning of every minute.

Fig. 6 is a rear elevation showing the second mode of forming contacts mentioned above. Here the circuit of the battery is closed through the terminal A′ in contact with the metallic clock-frame, the contact-spring *a′*, the lever *b*, the contact-faces *c′ c′*, the terminal B′, and the coil of the electro-magnet P. As in the previous arrangement, the contact is made in two stages or periods. In the first stage a tooth of the wheel K′, by coming in contact with the projection *j*, repels the lever *h*, so that the projection *g′* of this auxiliary lever, which supports the pin *f* of the contact-lever *b*, passes behind the said pin *f* and allows the lever *b* to drop until the projection *b′* of the lever *b* touches a tooth of the wheel K′. This first drop brings the two contact-faces *c′ c′* close together. In the second period, while the ratchet-wheel K′ continues to revolve, the projection *b′* reaches the edge of the tooth of the ratchet-wheel, and then drops again until lever *b*, pushed by the contact-spring *a′*, has produced contact between the faces *c′ c′*. The spring *i* tends to keep lever *h* in contact with ratchet-wheel K′.

We will now describe the appliances for breaking contact and for the automatic winding. Fig. 1 is a front elevation showing the first of the two modes of construction which we employ. Fig. 2 are detail views showing the principal parts of the same mechanism. The armature Q of the electro-magnet P is pivoted at its lower end *q* and has an upward extension R, provided with a plate R′, between which and the part R is pivoted a lever S S′. The two arms of the latter are of unequal length and unequal weight. The shorter and lighter arm S has a recess *s*, into which projects a pin *e*, fixed to the lever R, for limiting the pivotal motion of the lever S. R^2 is the fulcrum of the lever S S′. The longer and heavier arm S′ has at its extremity two teeth *t′ t′*, adapted to come in contact with a fixed stop-piece T. The motion of the lever R (away from the magnet) is limited by a buffer U, formed by an india-rubber ring surrounding a fixed stud. The fly-wheel V is fixed on a horizontal shaft *a*, Fig. 4, and carries a projecting pin *v*, which, owing to the unequal distribution of the weight of the fly-wheel, is always situated in front of the striking-lever R, as indicated by Fig. 1, when the fly-wheel is at rest. Consequently a sudden forward motion of the striking-lever R, produced by the attraction of the armature toward the electro-magnet, causes the lever to strike violently against the pin *v* and to turn the fly-wheel in the direction of the arrow. A second pin *v′* is attached to the fly-wheel, and a pawl or stop-lever W is suspended freely in such a position that during the revolution of the fly-wheel the pin *v′* passes underneath the lever W and lifts the same, but is afterward prevented from returning. To limit the pivotal motion of the pawl W, the latter is provided with a pin *w*, guided in a slot of the bracket Z, which supports the extremity of the axle *a* and also the pivot of the pawl W. With a sufficient impulse from the striking-lever R, aided by the unequal weight of the fly-wheel, the pin *v* will strike the short arm S of the lever S S′, so as to turn on its fulcrum and allow the pin *v* to pass into its position in front of the striking-lever R. The energy absorbed in lifting the heavy arm S′ from its support T is sufficient to prevent the fly-wheel from making more than one complete revolution. On the fly-wheel shaft *a*, Fig. 4, is fixed a pinion which gears into a spur-wheel X, mounted on the axle *x* of the small cylinder K, mentioned above. This axle also carries a pinion which gears into a spur-wheel Y, united by a copper tube *y* with the clock-spring situated in the spring-barrel *y′*. On the fly-wheel shaft *a* is a spur-wheel Y′, meshing with the pinion B on the shaft A, which carries a spur-wheel 1, meshing with a pinion 2 on a shaft 3, which carries the escapement-wheel 4. In consequence of this arrangement the turning of the fly-wheel has the following effects: first, to turn the cylinder K so as to interrupt the circuit of the electro-magnet; second, to wind at each interval of time—for instance, every minute—the spiral spring in the barrel *y′* as much as it had been relaxed in producing the motion of the clock during the same interval of time. It is to be observed that the passage of the current in the electro-magnet is very short, because it requires the coincidence of position of the springs H′ and J or H and J′. After each turning of the fly-wheel one of the springs J or J′ is continuously in contact with the cylinder K; but the circuit is not closed, owing to the corresponding spring H′ or H being insulated up to the moment that the going-work has caused the cylinder C to turn until the spring H′ or H falls upon the binding-post G. In this moment the fly-wheel is set in motion, but the cur-

rent is again interrupted after the wheel has made a quarter-turn. As the fly-wheel makes a whole turn in half a second, the contact lasts only one-eighth of a second. The contact-springs may press on the contact-faces with considerable force without interfering with the motion of the clock-work, because the pressure is applied neither to the escapement nor to the fly wheel, but only to the seconds-motion shaft. When the contact is broken, the lever R will easily fall back from the electro-magnet under the influence of its own weight and of a small leaf-spring *t* acting upon the lever; but if the armature should still adhere to the magnet when the pin *v* passes the upper end of the lever R the pin would press upon the inclined face of the latter and thereby detach the armature from the magnet. To prevent the lever R from falling back before the lever S S′ has received the stroke from the pin *v* of the fly-wheel, (and thereby consumed the energy of the latter,) the extremity of the long arm S′ has a pair of teeth *t′ t′*, between which the upper end of the piece T rests, as shown in Fig. 2, until the arm S′ is lifted. One Leclanché cell suffices to drive such a clock system. If a stronger current is used, the impulse given to the fly-wheel might be strong enough to turn it several times. It is to prevent this that the lever S S′ has been applied so as to place an obstacle in the way of the fly-wheel.

Fig. 5 represents a modification of the fly-wheel mechanism just described. The striking-lever *q′*, extending upward from the armature Q′, terminates at the top with an enlargement *r*, carrying a brake-spring *r′*. This spring *r′*, of which Fig. 7 shows a plan, has a projection r^2 sufficiently wide that, however slowly the lever *q′* may fall back into its position of rest, it will always interpose an obstacle to the motion of the fly-wheel, so as to prevent it from making more than one revolution by coming in contact either with the pin *s′* or with the pin s^2. To prevent the fly-wheel from turning back, we may employ a pawl W′, as described above, or a spring pressing on a projection of the fly-wheel shaft, or any other suitable device. This mechanism works as follows: As soon as the circuit of the electro-magnet is closed the striking-lever *q′* is thrown forward and gives an impulse to the fly-wheel. The hub of the fly-wheel carries at the back a pin s^3, (shown in Fig. 6 by dotted lines,) adapted to come in contact during its revolution with a lever *d*, fixed on the axle *e′*, on which is fixed the lever *b*. Consequently the turning of the fly-wheel causes the pin s^3 to lift the lever *d*, and thereby also the lever *b*. The pin *f*, which is lifted with the lever *b*, allows the lever *h* to turn forward under the influence of the spring *i*, so as to place the projection *g* underneath the pin *f* and prevent the lever *b* from falling. The forward motion of the lever *h* is stopped by the projection *j* coming in contact with one of the teeth of the ratchet-wheel K.

What we claim is—

1. In an electric clock, the combination of an electro-magnet with an electric circuit adapted to excite the said magnet at regular intervals of time, an unequally-weighted fly-wheel mounted on a horizontal axle and adapted to act on the clock mechanism, a striking-lever connected with the armature of the electro-magnet and adapted to give to the fly-wheel at every attraction of the armature an impulse sufficient for an entire revolution, and a brake device adapted to consume any excess of energy of the fly-wheel, substantially as described, and for the purpose specified.

2. In an electric clock, the combination of an electro-magnet with an electric circuit adapted to excite the said magnet at regular intervals of time, an unequally-weighted fly-wheel mounted on a horizontal axle and adapted to act on the clock mechanism, a striking-lever connected with the armature of the electro-magnet and adapted to give to the fly-wheel at every attraction of the armature an impulse sufficient for an entire revolution, a brake device adapted to consume any excess of energy of the fly-wheel, and a check-lever or detent adapted to prevent the fly-wheel from turning back, substantially as described, and for the purpose specified.

3. In an electric clock, the combination of an electro-magnet with an electric circuit controlling the said magnet, a circuit-closer controlled by the going-work of the clock and adapted to close the circuit at constant intervals of time, an unequally-weighted fly-wheel connected with the clock-motor and adapted to wind the same between given limits at every turn of the fly-wheel, a striking-lever connected with the armature of the electro-magnet and adapted to give to the fly-wheel at every attraction of the armature an impulse sufficient for an entire revolution, a brake device adapted to consume any excess of energy of the fly-wheel, and a circuit-breaker adapted to be worked by the fly-wheel so as to interrupt the electric circuit after the fly-wheel has traveled a given distance, substantially as described, and for the purpose specified.

4. The combination, with a clock-work, of an electric circuit comprising an electro-magnet, a circuit-closer connected with the going-work of the clock and controlled by the same so as to close the said circuit at given intervals of time, an unequally-weighted fly-wheel connected with the clock-spring and adapted to wind the same within given limits during its forward motion, a lever connected with the armature of the said electro-magnet and adapted to give to the fly-wheel at every attraction of the armature an impulse at least sufficient for an entire revolution of the fly-wheel, a circuit-breaker adapted to be controlled by the fly-wheel so as to interrupt the circuit of the electro-magnet at every time when the fly-wheel has turned a given dis-

tance or angle from its starting position, a check-lever adapted to prevent the fly-wheel from turning back, and a brake device adapted to prevent the fly-wheel from turning too far, substantially as described, and for the purpose specified.

5. The combination of a clock-work with an electric circuit, an electro-magnet controlled by the said circuit, an armature-lever adapted to be attracted by the said magnet and carrying at its free end a brake-spring, an unequally-weighted fly-wheel connected with the going-work of the clock and adapted to wind the mainspring, the said fly-wheel being adapted to receive an impulse from the armature-lever sufficient at least for an entire revolution of the fly-wheel and to meet the said brake-spring after a given travel of the fly-wheel, so as to prevent the latter from making more than one revolution, substantially as described, and for the purpose specified.

6. The combination of a clock-work with an electric circuit, an electro-magnet controlled by the said circuit, an armature-lever adapted to be attracted by the said magnet and carrying at its free end a brake-spring, an unequally-weighted fly-wheel connected with the going-work of the clock and adapted to wind the mainspring within given limits, the said fly-wheel being adapted to receive an impulse from the armature-lever sufficient at least for an entire revolution of the fly-wheel and to meet the said brake-spring after a given travel of the fly-wheel, so as to prevent the latter from making more than one revolution, and a pawl or detent to prevent the fly-wheel from turning backward, substantially as described.

7. In an electric clock, the combination, with the electric circuit, of an electro-magnet and a pair of contacts included in the said circuit, a contact-lever carrying the movable contact and adapted to press the same against the fixed contact, an auxiliary lever adapted to keep the contact-lever away from the fixed contact, a ratchet-wheel connected with the going-work of the clock and controlling the position of the said levers, and a fly-wheel mechanism adapted to be worked by the said electro-magnet and to remove the contact-lever from the fixed contact after the fly-wheel has traveled a given distance, substantially as described, and for the purpose specified.

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

DÉSIRÉ VANDE PLANCKE.
GUSTAVE VANDE PLANCKE.

Witnesses:
GEORGE BEDE,
AUG. GÉNARD.