No. 813,161. PATENTED FEB. 20, 1906.

M. MENKIN.

SELF WINDING ELECTRIC CLOCK.

APPLICATION FILED MAR. 30, 1904.

4 SHEETS—SHEET 1.

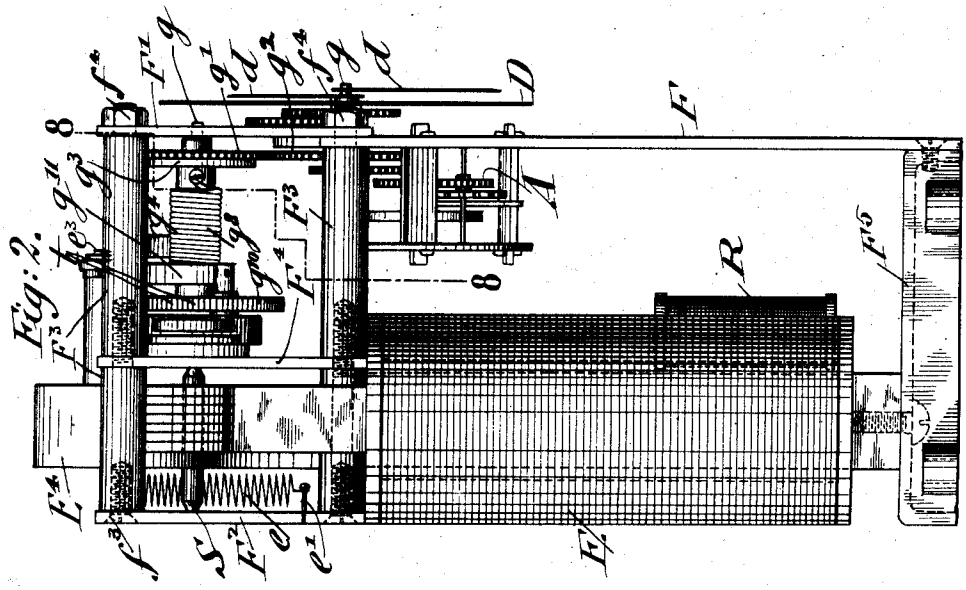

Fig. 2.

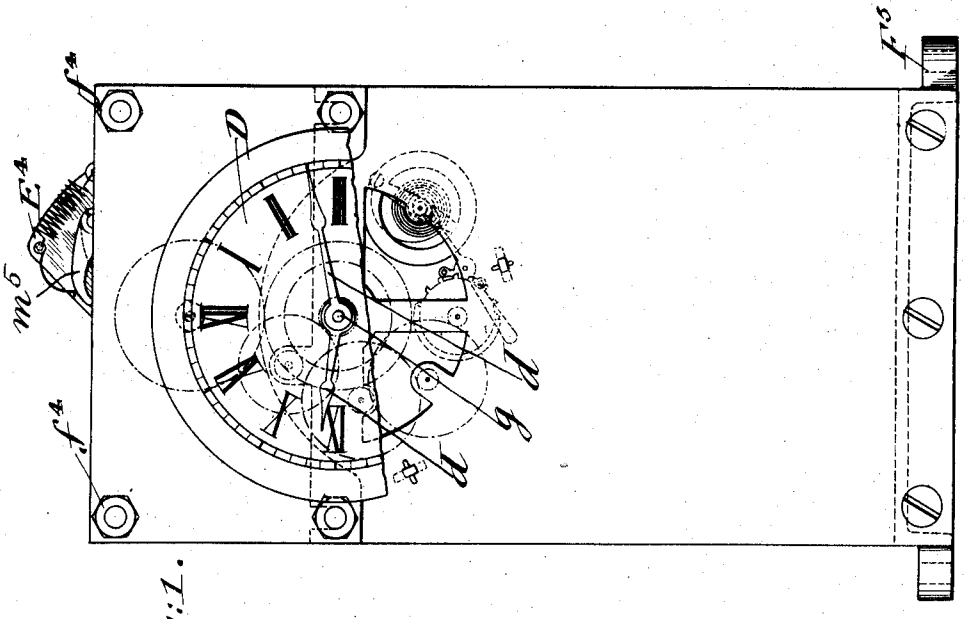

Fig. 1.

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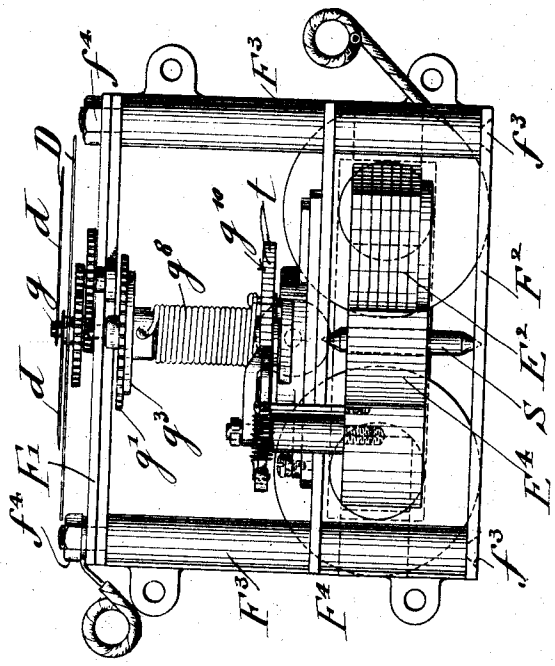
4 SHEETS—SHEET 2.

Fig. 4.



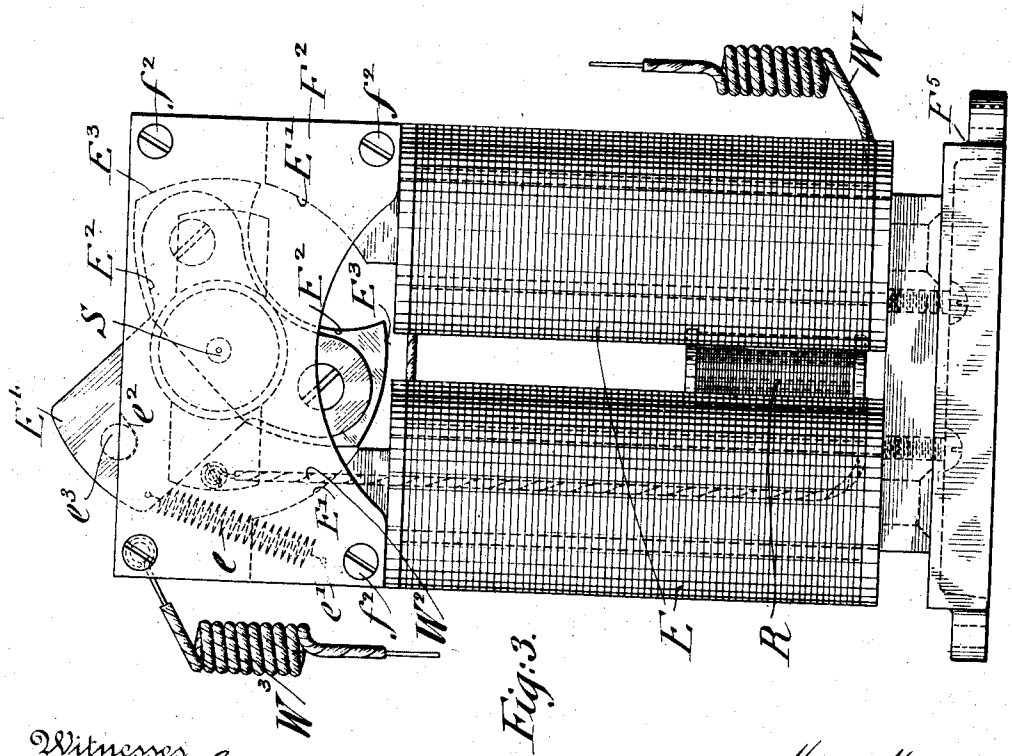




Fig. 3.

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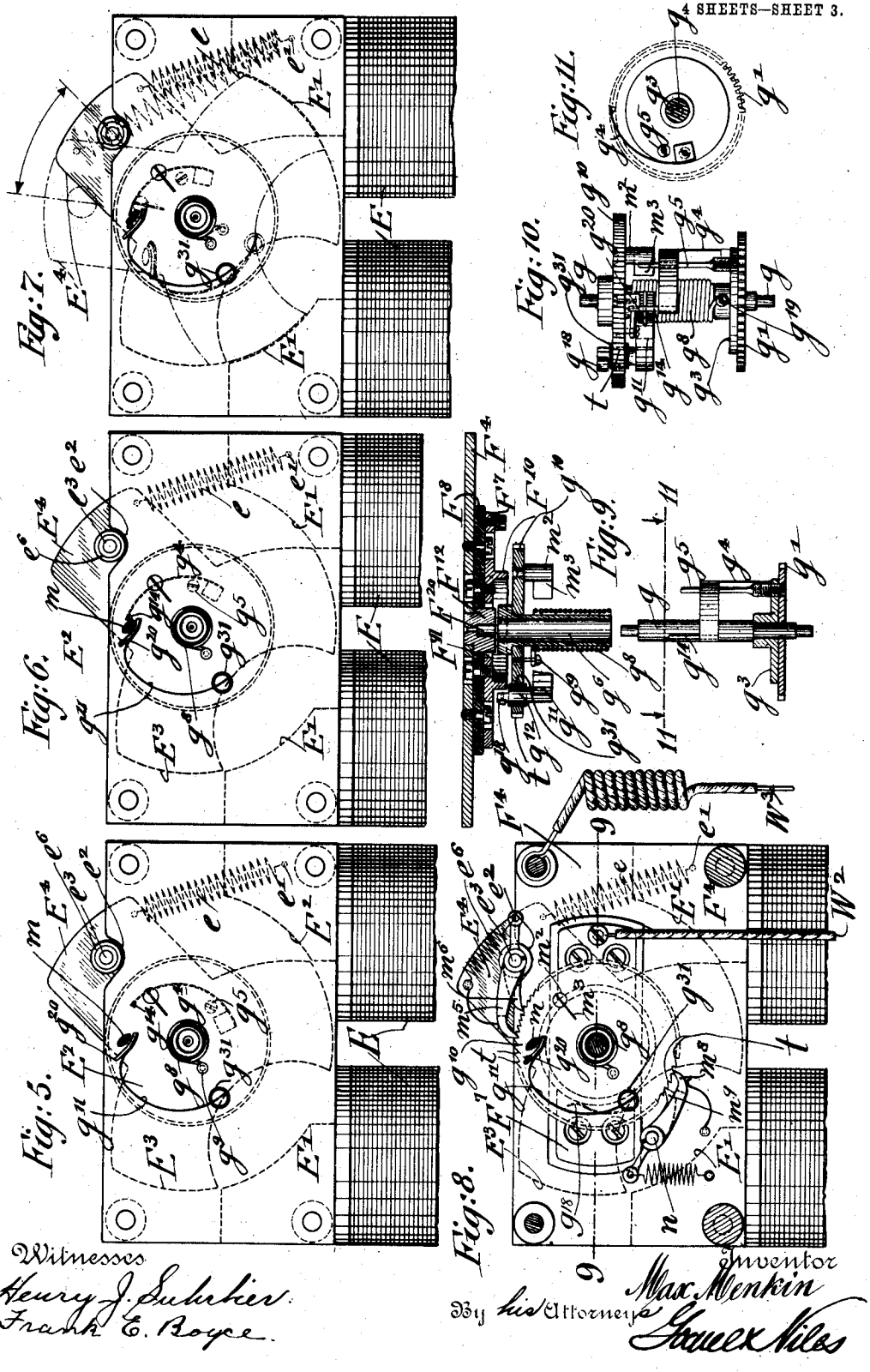
4 SHEETS—SHEET 3.

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4 SHEETS—SHEET 4.

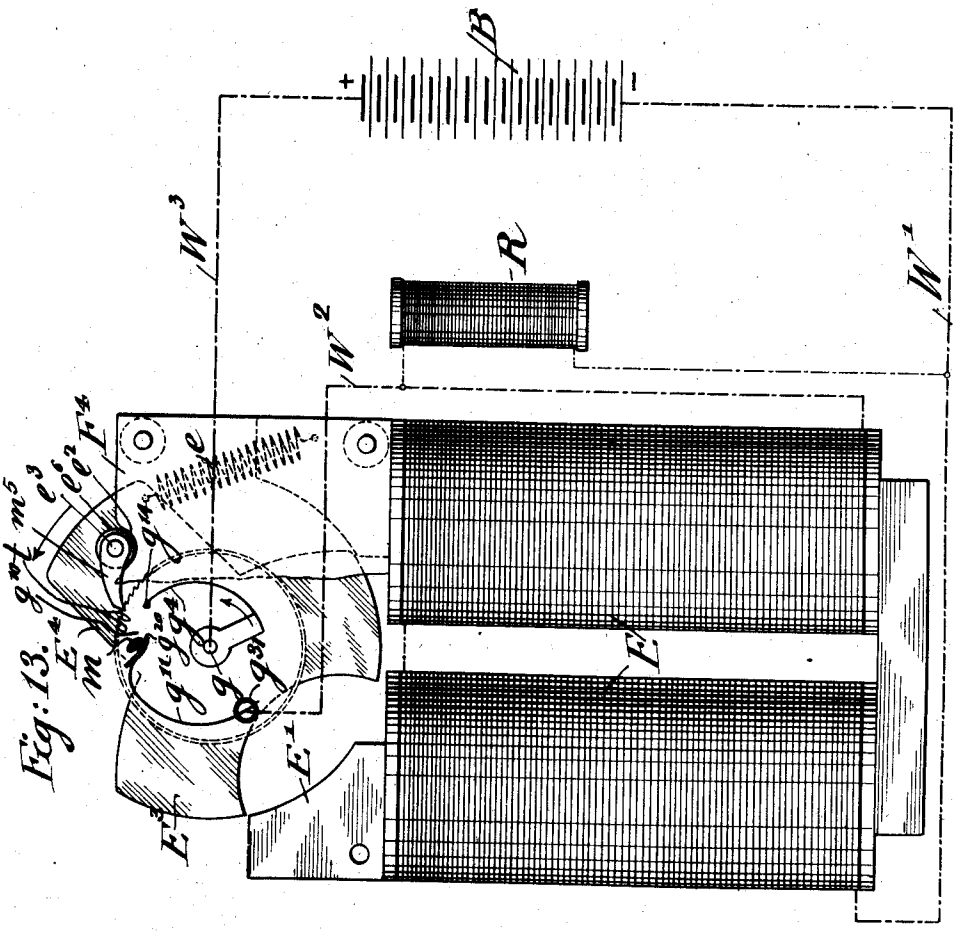


Fig. 13.

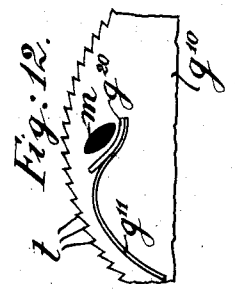


Fig. 12.

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# UNITED STATES PATENT OFFICE.

MAX MENKIN, OF NEW YORK, N. Y.

## SELF-WINDING ELECTRIC CLOCK.

No. 813,161. Specification of Letters Patent. Patented Feb. 20, 1906.

Application filed March 30, 1904. Serial No. 200,776.

*To all whom it may concern:*

Be it known that I, MAX MENKIN, a subject of the Czar of Russia, residing in New York, borough of Manhattan, and State of New York, have invented certain new and useful Improvements in Self-Winding Attachments for Clocks, of which the following is a specification.

This invention relates to improvements in clocks, and more especially to self-winding attachments for clocks, and to electromechanical devices for actuating the mechanism of the works of marine clocks or other mechanisms which run irrespective of their position and in which the pendulum is dispensed with and a balance-wheel or governor employed to allow the actuating power to be gradually expended, said power being intermittently restored by the winding up of the motor-spring by the intermittent closing of an electric circuit and the actuation of an armature of an electromagnet in said circuit.

The object of the invention is to provide an actuating device for clocks having means for intermittently closing and immediately thereafter opening the electric circuit for actuating the armature of an electromagnet, and thereby intermittently winding a motor-spring, said means being intended to be of simple construction, compact, cheap, efficient, using very little current, and having a self-cleaning contact and far superior to the more complicated actuating devices used hitherto.

For this purpose the invention consists of an improved device for actuating clockworks and other mechanisms, which comprises an electromagnet, an oscillating armature provided with pawls actuated by the magnet, an arbor provided with a pinion engaging the clockwork or other mechanism, and with a loosely-mounted toothed wheel, engaged by the pawls of the armature, a motor-spring, one end of which is connected with the loosely-mounted toothed wheel, while the other end is connected with the arbor, and means for intermittently closing the circuit of the electromagnet for actuating the armature, rotating the toothed wheel, and so winding up the motor-spring, which on unwinding rotates the arbor and actuates the clock or other mechanism with which the pinion of the arbor engages.

The invention consists more particularly of means for intermittently closing the electric circuit for actuating the electromagnet, and so rewinding the motor-spring, which means, together with other novel features, will be more fully described hereinafter and finally pointed out in the claims.

In the accompanying drawings, Figure 1 represents a front view of the frame of a clock having a part of the dial broken away and provided with my improved actuating device. Fig. 2 is a side view of Fig. 1. Fig. 3 shows a rear view of Fig. 2. Fig. 4 is a top view of Fig. 3, but with the contact-making terminals omitted for the sake of clearness. Figs. 5, 6, and 7 show rear views of the upper part of the electromagnet and the armature, showing different positions of the means used in my improved actuating device for intermittently closing the current. Fig. 8 shows a front view, partly in section, taken on line 8 8, Fig. 2. Fig. 9 shows a horizontal section through Fig. 8, taken on line 9 9, but showing the arbor withdrawn in order to show more clearly the component parts of my improved actuating device. Fig. 10 shows a top view of the means for intermittently closing the current forming part of my improved actuating device. Fig. 11 shows a detail view of one terminal of the current-closing means, taken on line 11 11 of Fig. 9. Fig. 12 shows a detail view of the other terminal of the current-closing means as arranged in proximity to a lintel-shaped projection; and Fig. 13 shows the electromagnet and the electrical circuit connected therewith.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents an ordinary clock-train which is attached to a supporting-plate F, to which a dial D of any suitable size is attached, over which indicating-hands $d$ move. On a base-plate $F^5$ is arranged an electromagnet, the pole-pieces of which support the framework of the improved self-winding mechanism. This framework consists of a front plate F′, a rear plate $F^2$, and transverse pillars $F^3$, which connect the front and rear plates. Intermediately between the front and rear plates is arranged a plate $F^4$, which is clearly shown in Figs. 2 and 9 and which is provided with openings for the passage of the connecting-pillars $F^3$. Each of the connecting-pillars is provided with a screw-thread at one end and provided with a screw-threaded socket at the other end, so as to permit the connection of one member with the other. Interposed between each member of the connecting-pillars is the intermediate plate $F^4$, while the lower

pillars also pass through the pole-pieces E′ of the electromagnet. For supporting the front and rear plates screws $f^3$, which engage the screw-threaded sockets of the pillars, and nuts $f^4$, which engage the screw-threaded ends of the pillars, are provided. By passing the pillars through the pole-pieces and connecting as described a device at once compact and easily assembled is produced. The electromagnet E is supported on the base-plate $F^5$. The cores of the electromagnet E are provided with the arc-shaped pole-pieces E′, which correspond in length and in shape to the ends $E^3$ of the armature $E^2$, that swings over the same and is keyed to a shaft S, the beveled or pointed ends of which engage pivot-holes of the rear and intermediate plates. The armature $E^2$ is preferably made of laminated plates, as shown in Fig. 4, for the purpose of obtaining a more sensitive actuation and cheaper construction than the solid armatures used hitherto. The plates are stamped from suitable material and then suitably joined, so forming the armature, which is provided with a third shank $E^4$, adapted to act as a counterbalancing-weight. A helical spring $e$ connects the armature-shank $E^4$ with a pin $e'$, projecting from the lower part of the rear plate. The intermediate plate $F^4$ is provided with a recess $e^2$, which conforms in shape to a pawl-carrying rod $e^3$, projecting from the armature-shank. The rod $e^3$ is covered with a layer $e^6$ of suitable material adapted to effect a cushioning when the rod abuts against the plate $F^4$ on the return movement of the armature, so as to arrest the movement of the same. The tension of the spring $e$ serves to return the armature in proper position in proximity to the pole-pieces and ready to be actuated on engaging the electromagnet.

To the front part of the intermediate plate $F^4$ is attached a plate $F^7$, having a collar $F^{10}$ and a central opening $F^{11}$, as shown clearly in Figs. 8 and 9. The plate $F^7$ is separated from the intermediate plate $F^4$ by a layer $F^8$ of insulating material, so as to insulate the plate $F^4$ from the plate $F^7$. Through the central opening $F^{11}$ of the plate $F^7$ and secured to the plate $F^4$ and in electrical connection therewith is a small disk $F^{12}$, provided with a pivot-hole $F^{20}$, intended to act as bearings for one end of an arbor or shaft $g$. The other end of the arbor or shaft $g$ is pivoted to the front wall F′ and provided with a wheel $g'$, meshing with a pinion $g^2$ of the clock-train or other mechanism to be actuated. Connected with the pinion $g'$ is a disk $g^3$, which supports a contact-terminal $g^4$ and a banking-rod $g^5$, the screw-threaded end of which engages a screw-threaded socket in the disk $g^3$, whereby it may be readily withdrawn or detached from the same. The contact-terminal $g^4$ is made of a plate-spring of L shape, one leg of which is connected with the disk $g^3$, while the other leg is bent into circular shape as to conform approximately to the circular periphery of the disk $g^3$. The free end of the terminal $g^4$ is provided with a small rod $g^{14}$, of platinum or other suitable metal, projecting toward the intermediate plate. Movable on the arbor $g$ is a ratchet-wheel $g^{10}$, provided at its periphery with a large number of ratchet-teeth $t$. A helical motor-spring $g^8$ is provided and has one end $g^{19}$ connected with the arbor and the other end $g^9$ connected with the ratchet-wheel $g^{10}$. To prevent the spring from pressing against the arbor and to insure an effective action of the parts, the ratchet-wheel $g^{10}$ is provided with a sleeve $g^6$, which is arranged intermediately between the arbor and spring.

On the front face of the ratchet-wheel $g^{10}$ is supported at $g^{12}$ a second contact-terminal $g^{11}$, insulated from the ratchet-wheel $g^{10}$ by a layer $g^{31}$ of insulating material. This contact-terminal $g^{11}$ is also made of a suitable plate-spring or other resilient material and of L shape, one leg of which is connected with the ratchet-wheel $g^{10}$, while the other leg is so arranged or bent as to be of circular shape, so as to conform approximately to the circular periphery of the ratchet-wheel $g^{10}$. The free end of the contact-terminal $g^{11}$ is provided with a small rod $g^{20}$, of platinum or other suitable material, of a shape corresponding to one side of a lintel-shaped projection $m$, arranged on the ratchet-wheel $g^{10}$, as shown most clearly in Fig. 12. The projection $m$ is preferably of insulated material. On the rear face of the ratchet-wheel $g^{10}$ is a contact-brush $g^{18}$, (shown most clearly in Figs. 9 and 10,) connected with the contact-terminal $g^{11}$ at $g^{12}$ and adapted to contact with the collar $F^{10}$ of the plate $F^7$, (shown most clearly in Fig. 8,) which is in electrical connection with the electromagnet E and battery B by means of the wire $W^2$. The front face of the ratchet-wheel $g^{10}$ is lastly provided with a projection $m^2$, supporting a small plate-spring $m^3$, which is adapted to arrest the movement of the terminal $g^4$ by acting as a bar to the banking-rod $g^5$, as shown most clearly in Fig. 10, and which will be more fully described hereinafter.

The pawl-supporting rod $e^5$ is provided with two spring-actuated pawls $m^5$ $m^6$, the position of which is clearly shown in Fig. 8, which positively engage the teeth $t$ of the periphery of the ratchet-wheel $g^{10}$. The intermediate plate $F^4$ is provided with a rod $n$, on which are supported spring-actuated pawls $m^8$ $m^9$, which are also clearly shown in Fig. 8 and which positively engage the teeth $t$ of the ratchet-wheel $g^{10}$ at a point of the ratchet-wheel approximately diametrically to the point of engagement of the pawls $m^5$ $m^6$ and which act as check-pawls. By the action of these sets of pawls, one of each set being arranged somewhat in advance of the other, any

backlash that may occur is taken up, thus enabling a ratchet-wheel of small diameter to be used and the greatest movement of the ratchet-wheel obtained for the amount of electrical energy expended.

Connected in shunt with the wires of the electromagnet is a spark-preventing coil R, adapted, as is well known, to prevent sparking at the contact-points $g^{14}$ and $g^{20}$ of the terminals $g^4$ and $g^{11}$. One of the conducting-wires W′ of the electromagnet is connected with one pole of the battery B, the other pole of which is connected with the intermediate plate $F^4$ by wire $W^3$. Instead of the battery B the conducting-wires may be connected with two terminals of any other suitable source of electricity. The plate $F^4$ is in electrical connection with the bearing $F^{20}$, arbor $g$, and contact-terminal $g^4$. The other wire $W^2$ of the electromagnet is connected with the plate $F^7$, which is in electrical connection with the collar $F^{10}$, brush $g^{18}$ contacting therewith, and contact-terminal $g^{11}$. The electrical circuit is clearly shown in Fig. 13.

In normal position the armature is in the position shown in Figs. 5, 6, 7, and 8, and the contact-making terminals $g^4$ $g^{11}$ are in the position shown in Fig. 5, the motor-spring $g^8$ being under tension. As the spring unwinds it causes the wheel $g'$ to rotate, and so actuate the clock-train or other mechanism connected therewith, simultaneously causing the contact-terminal $g^4$ to move toward the other contact-terminal $g^{11}$. The projection $m$ is preferably lintel-shaped, having its major axis aranged in obliquity to the direction of movement of the approaching contact-terminal $g^4$, so that the rod $g^{14}$ of the terminal $g^4$ encounters the lower part of the projection and is somewhat moved radially outward during its movement on the same, whereby the terminal $g^4$ is set to tension, so that at the end of the movement of the rod $g^{14}$ on the projection it drops quickly upon the rod $g^{20}$ of the terminal $g^{11}$, making a firm contact with the same. By the contact thus produced the electric circuit is closed, the electromagnet E energized, the armature $E^2$ actuated, and the shanks $E^3$ brought into alinement with the projecting pole-pieces E′, setting the spring $e$ by this movement to tension. By the movement of the armature $E^2$ the pawls $m^5$ $m^6$, which engage the teeth of the ratchet-wheel $g^{10}$, cause the ratchet-wheel $g^{10}$ to be rotated, and thereby rewind the motor-spring, setting it to tension. By this movement the rod $g^{20}$ of the terminal $g^{11}$ and the projection $m$ are moved away from the other rod $g^{14}$ of the terminal $g^4$ in such a manner that the rod $g^{14}$ of the terminal $g^4$ is caused to glide along the lower side of the lintel-shaped projection, this time in opposite direction to its movement on the upper side of the same.

The rod $g^{14}$ of the terminal $g^4$ remains relatively stationary, and the projection $m$ and rod $g^{20}$ of the terminal $g^{11}$ quickly move away from the stationary rod. The movement of the lintel-shaped projection causes the terminal $g^4$ to be set somewhat to tension, the terminal $g^{11}$ being already set to tension by the rod $g^{14}$ of the terminal $g^4$ being interposed between the rod $g^{20}$ and projection $m$. Thus immediately before the separation of the terminals $g^4$ and $g^{11}$ both are set to tension, so that when they finally separate they do so very rapidly and instantly break contact. This breaks the electrical contact and the armature $E^2$ is released, whereby it promptly returns, actuated by the spring $e$, to its original position, so that the pawl-supporting rod $e^3$ abuts against or rests on the plate $F^4$. The armature $E^2$ remains in this position during the gradual unwinding of the spring $g^8$ until by this unwinding the contact-terminal $g^4$ is again brought into contact with the contact-terminal $g^{11}$ in a similar manner as hereinbefore described, so that the electric circuit is closed, the electromagnet energized, the motor-spring rewound, and the rods $g^{14}$ and $g^{20}$ simultaneously separated. This contact making and breaking takes place intermittently at suitable intervals commensurate with the even tensioning of the motor-spring, thus continuously maintaining it at an even tension, so as to efficiently actuate thereby the clock-train or other mechanism. The contact-making device described is self-cleaning and of simple construction, permitting it to be made cheaply and requiring little or no attention as compared with the expensive and more complicated devices heretofore employed. When the batteries are weak, the rods $g^{14}$ and $g^{20}$ of the terminal will contact and close the circuit; but the current of the circuit will be too weak to actuate the armature and rotate the ratchet-wheel $g^{10}$, which would, as above described, cause the separation of the contact-terminals. Hence by the continued unwinding of the motor-spring $g^6$ the rod $g^{14}$ of the terminal $g^4$ will pass along the other terminal $g^{11}$, permitting the terminals to arrange themselves in such a position that when the batteries are replaced and a full current supplied and the terminals actuated, as described, the separation would be such as to be liable to cause destruction, and thus necessitate repairs, or if the terminals are not sufficiently actuated as to cause the separation of the same a short-circuit of the battery would result. To prevent this and in order that the rods of the terminals be always in position for starting when the batteries are connected, so as to cause a proper separation of the terminals, the rod $m^2$, supporting a banking-spring $m^3$, is provided and secured to the ratchet-wheel $g^{10}$ in such a manner as to form an obstruction to the passage of the banking-rod $g^5$, detachably secured to the disk $g^3$, so as to arrest the movement of the terminal $g^4$. By these means the proper

position of the contact-rods of the terminals is insured, so that when the armature has been swung over the poles of the magnet it will not fail to move the plate $g^{10}$, terminal $g^{11}$, and projection $m$ sufficiently to release terminal $g^4$ from between the projection $m$ and terminal $g^{11}$. Thus when the batteries have not sufficient strength to actuate the armature, and so move the plate $g^{10}$, terminal $g^{11}$, and projection $m$ away from the other terminal $g^4$, the force of the motor-spring will carry the terminal $g^4$ only immediately beyond the projection $m$, when the banking-rod $g^5$ will abut against the banking-spring $m^3$, and so maintain the contacts in position in order to act properly when the new batteries are supplied. Furthermore, the banking arrangement does not allow the motor-spring to expend all the tension previously given to it, so that it may have an even tension between the intermittent rewinding, causing thereby an even running of the mechanism which it actuates. This feature is specially important with clocks. For purposes of repair and adjustment the banking-rod $g^5$ is made detachable.

The contact-making device described, comprising the terminals and banking arrangement, is arranged with a view to be assembled easily, the parts being simple in construction, thereby reducing the cost of manufacture of the device.

The device or attachment described can also be applied for winding other spring-actuated mechanism, such as are employed in telegraph-registers, phonographs, and other apparatus.

I claim as new and desire to secure by Letters Patent—

1. A self-winding attachment for clocks, consisting of a supporting-frame formed of front and rear plates and connecting-pillars, a clock-train, a dial and hands therefor supported by one of the plates, an intermediate plate interposed between the front and rear plates and supported by said pillars, an electromagnet, an armature for the same, spring-actuated pawls on the armature, a shaft for the armature journaled in the intermediate and rear plates, an arbor journaled in the intermediate and front plates, a pinion at one end of the arbor engaging the clock-train, a plate secured to the pinion of the arbor and provided with a contact-terminal, a ratchet-wheel movable on the arbor and adapted to be engaged by the pawls of the armature, a contact-terminal supported by the ratchet-wheel, a motor-spring having its ends secured to the arbor and to the ratchet-wheel, a source of electricity, and conductors electrically connecting the electromagnet, source of electricity and contact-terminals.

2. In a self-winding attachment for clocks, the combination of a mainspring, a shaft in connection with the inner end of the mainspring, a movable member connected with and operated by the shaft, a second movable member connected with and operated by the outer end of the mainspring, a source of electricity, a contact-terminal for each member, each connected with one pole of the source of electricity, and a lintel-shaped projection on the second member in close proximity to the contact-terminal thereon, the major axis of the projection and the direction of movement of the contact-terminal of the first member being in obliquity to each other, the projection being adapted to gradually tension the contact-terminal of the first member on its approach to the contact-terminal of the second member, release the so-tensioned contact-terminal of the first member, at the end of its path thereon, so as to cause it to forcibly contact with the contact-terminal of the second member, and adapted to act as a guide and cause the contact member of the first member to be tensioned when the same passes between it and the contact-terminal of the second member.

3. A self-winding attachment for clocks, comprising a mainspring, a shaft connected with the mainspring, a movable member secured to the shaft, a second movable member connected with and operated by the outer end of the mainspring, a lintel-shaped projection on one of said members, a source of electricity, and a contact-terminal for each movable member, connected with a pole of the source of electricity, the contact-terminal on the member supporting the projection being in proximity to and conforming substantially to the contour of the projection, while the contact-terminal of the other movable member is provided with an end adapted to pass along the projection.

4. In a self-winding attachment for clocks, the combination of a mainspring, a shaft in connection with the inner end of the mainspring, a movable member connected with and operated by said shaft, a second movable member connected with and operated by the outer end of the mainspring, a lintel-shaped projection on one of said members, a source of electricity, and a contact-terminal for each member, each connected with a pole of the source of electricity, one of said contact-terminals being provided with an end conforming substantially to the contour of the lintel-shaped projection and the other of said contact-terminals being provided with an end adapted to pass along the projection, said end being at an angle to the other contact-terminal when in contact therewith.

5. In a self-winding attachment for clocks, the combination of a mainspring, a shaft in connection with the inner end of the mainspring, a movable member connected with and operated by the shaft, a second movable

member connected with and operated by the outer end of the mainspring, and contact-terminals, one on each member, each connected with a pole of a source of electricity and each yieldingly supported and each adapted to be resiliently strained when in electrical connection with the other, said contact-terminals being so arranged that the contact-terminal of the first member gradually approaches the contact-terminal of the second member, until it contacts with the same, after which the contact-terminal of the second member moves away from the contact-terminal of the first member.

6. In a self-winding attachment for clocks, the combination of a fixed supporting-plate connected with one pole of a source of electricity, a plate secured to the supporting-plate but insulated therefrom, having a central opening and connected with the other pole of a source of electricity, a collar on said insulated plate, a shaft pivotally supported by the supporting-plate, passing through the central opening of the insulated plate but not in contact therewith, a contact-terminal movable with said shaft, a ratchet-wheel movable in respect to the shaft, a contact-terminal on the ratchet-wheel insulated therefrom but in electrical connection with the collar on the insulated plate, a lintel-shaped projection on the ratchet-wheel in proximity to the end of the last-named terminal, and a motor-spring connecting the shaft and the ratchet-wheel.

7. In a self-winding attachment for clocks, the combination of a mainspring, a shaft in connection with the inner end of the mainspring, a member connected with and operated by the shaft, a second member connected with and operated by the outer end of the mainspring, means adapted to periodically tension the mainspring, and means on each of said members projecting laterally therefrom, adapted when in engagement with each other, after a partial unwinding of the mainspring but with the mainspring still under tension, to limit the movement of the members so as to prevent the further unwinding of the mainspring.

8. In a self-winding attachment for clocks, the combination of supporting-plates, a shaft pivotally supported by said supporting-plates, a movable member secured to said shaft, a banking-rod on said member, a second movable member rotatable on said shaft, a banking-blade on said second member, adapted to arrest the movement of the banking-rod, a motor-spring having its ends connected with the members, and contact-terminals on each of said members.

9. In a self-winding attachment for clocks, the combination of a mainspring, a shaft carrying the inner end of the mainspring, a member connected with and operated by the shaft, a second member connected with and operated by the outer end of the mainspring, a source of electricity, contact-terminals on said members each connected with a pole of the source of electricity, a lintel-shaped projection on one of said members in proximity to the contact-terminal thereon, a banking-rod on one member, and a banking-blade on the other adapted to arrest the movement of the banking-rod.

10. In a self-winding attachment for clocks, the combination of supporting-plates, a shaft pivotally supported by said supporting-plates, a movable member secured to said shaft, a banking-rod detachably secured to said member, a second movable member rotatable on said shaft, a banking-blade on said second member adapted to arrest the movement of the banking-rod, a motor-spring having its ends connected with the members, a contact-terminal on each of said members, a collar secured to one of said supporting-plates but insulated therefrom, a brush on the second member in electrical connection with the collar and with the contact-terminal on said member, a source of electricity, and means connecting said collar and the contact-terminal of the first member with the poles of said source of electricity.

11. In a self-winding attachment for clocks, the combination of an electromagnet, a source of electricity, an electrical connection between said magnet and said source of electricity, a plurality of supporting-plates supported by the poles of the electromagnet, an armature movable between the poles of the electromagnet, a shaft for the armature journaled in two adjacent supporting-plates, means between the two other adjacent plates adapted to close the electric circuit of the electromagnet for actuating the armature, means for returning the armature to its normal position, and means for limiting the return movement of the armature.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

MAX MENKIN

Witnesses:
PAUL GOEPEL,
HENRY J. SUHRBIER.