No. 708,112. Patented Sept. 2, 1902.

H. E. ANDERSSON.

ELECTRIC CLOCK.

(Application filed Dec. 1, 1900.)

(No Model.)

4 Sheets—Sheet 1.

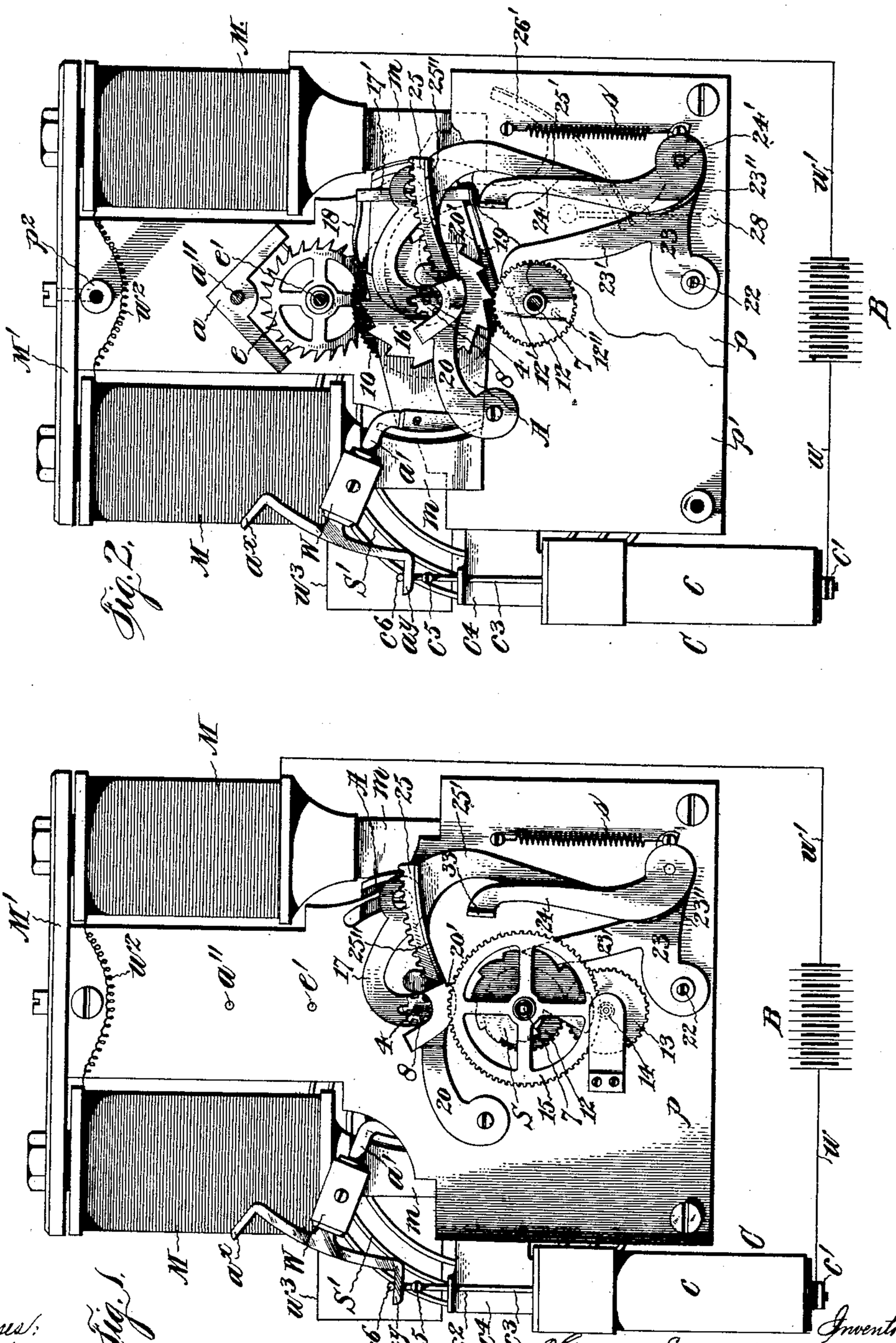

Fig. 2.

Fig. 1.

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Attys.

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(No Model.) 4 Sheets—Sheet 2.

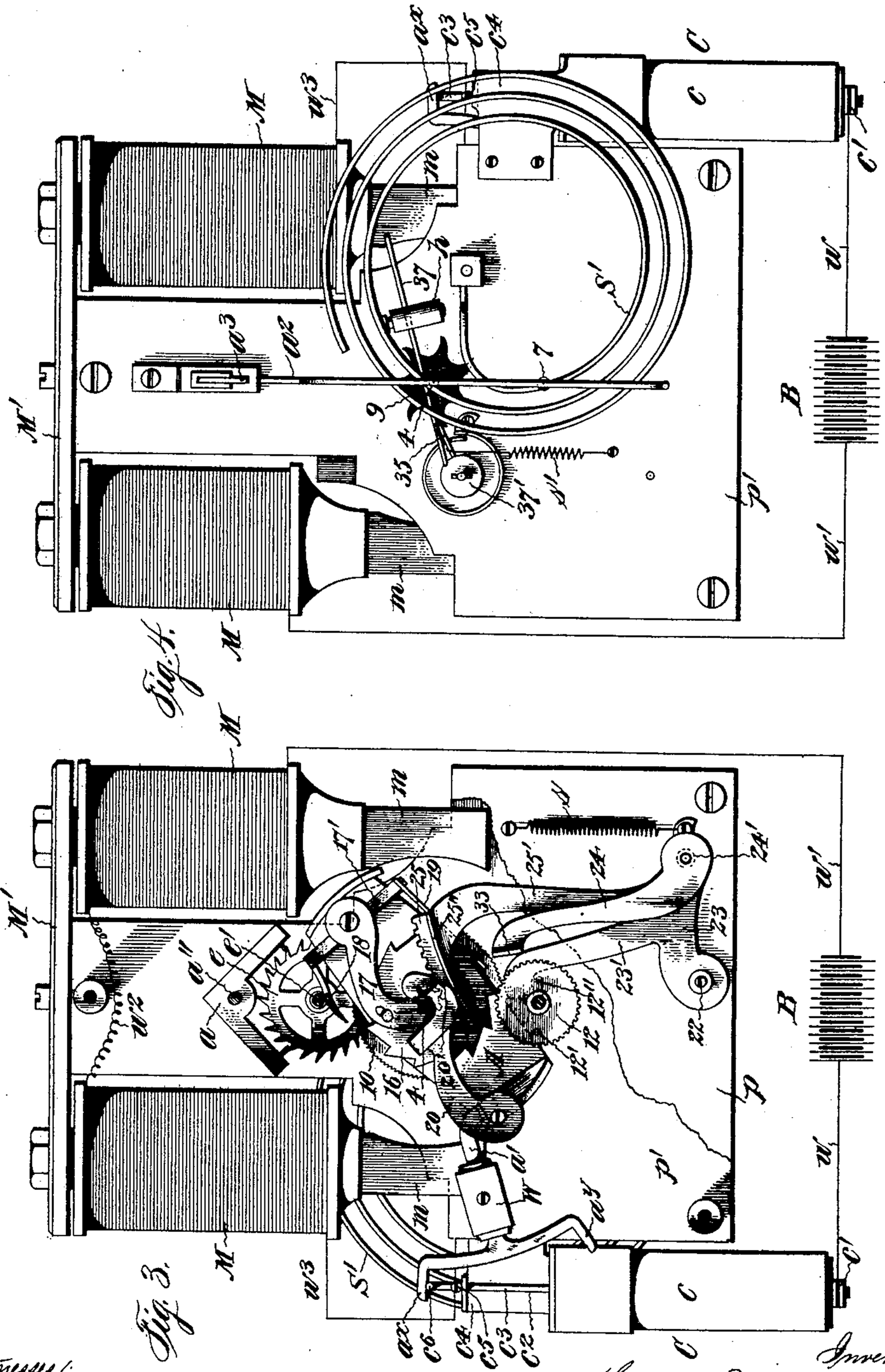

Fig. 3.

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(No Model.) 4 Sheets—Sheet 3.

Fig. 6.

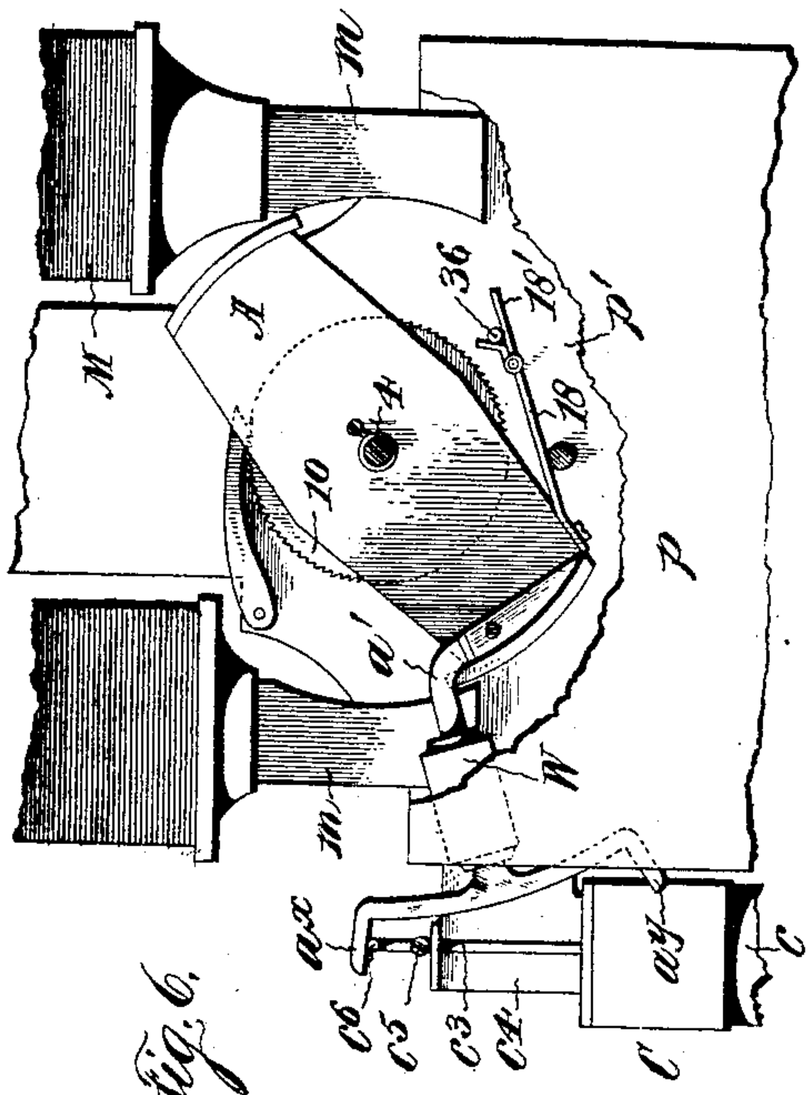


Fig. 7.

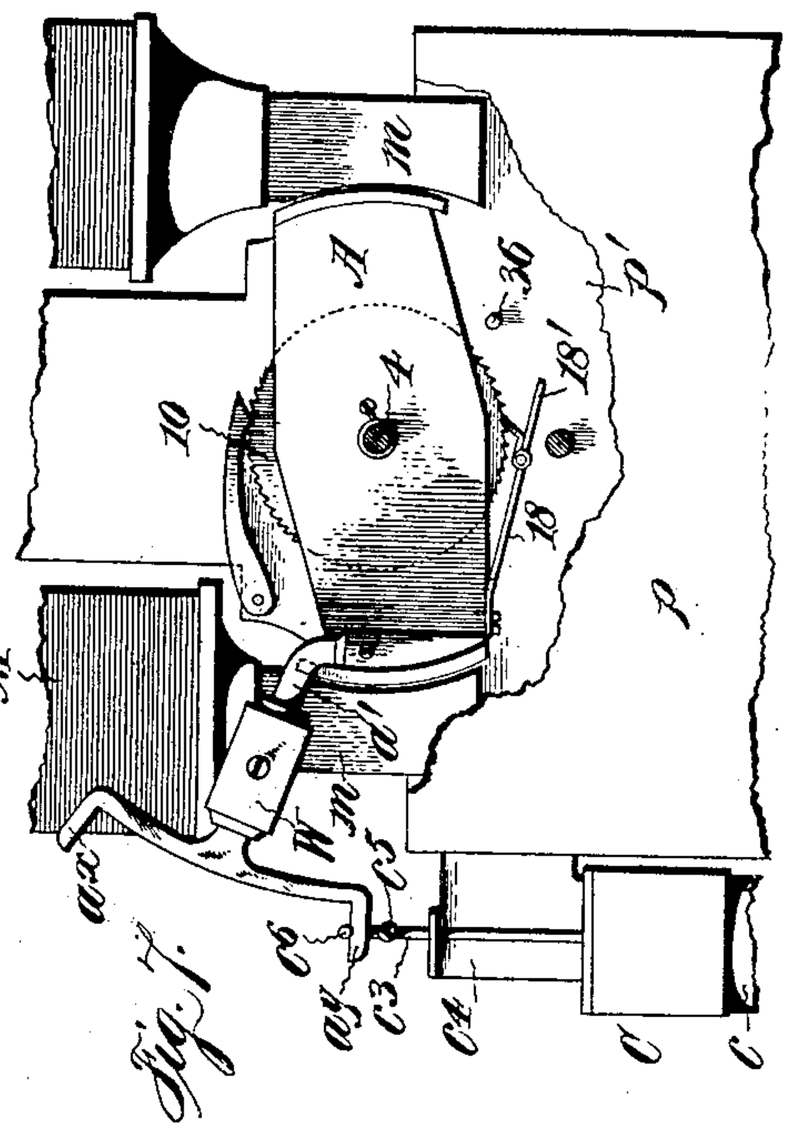
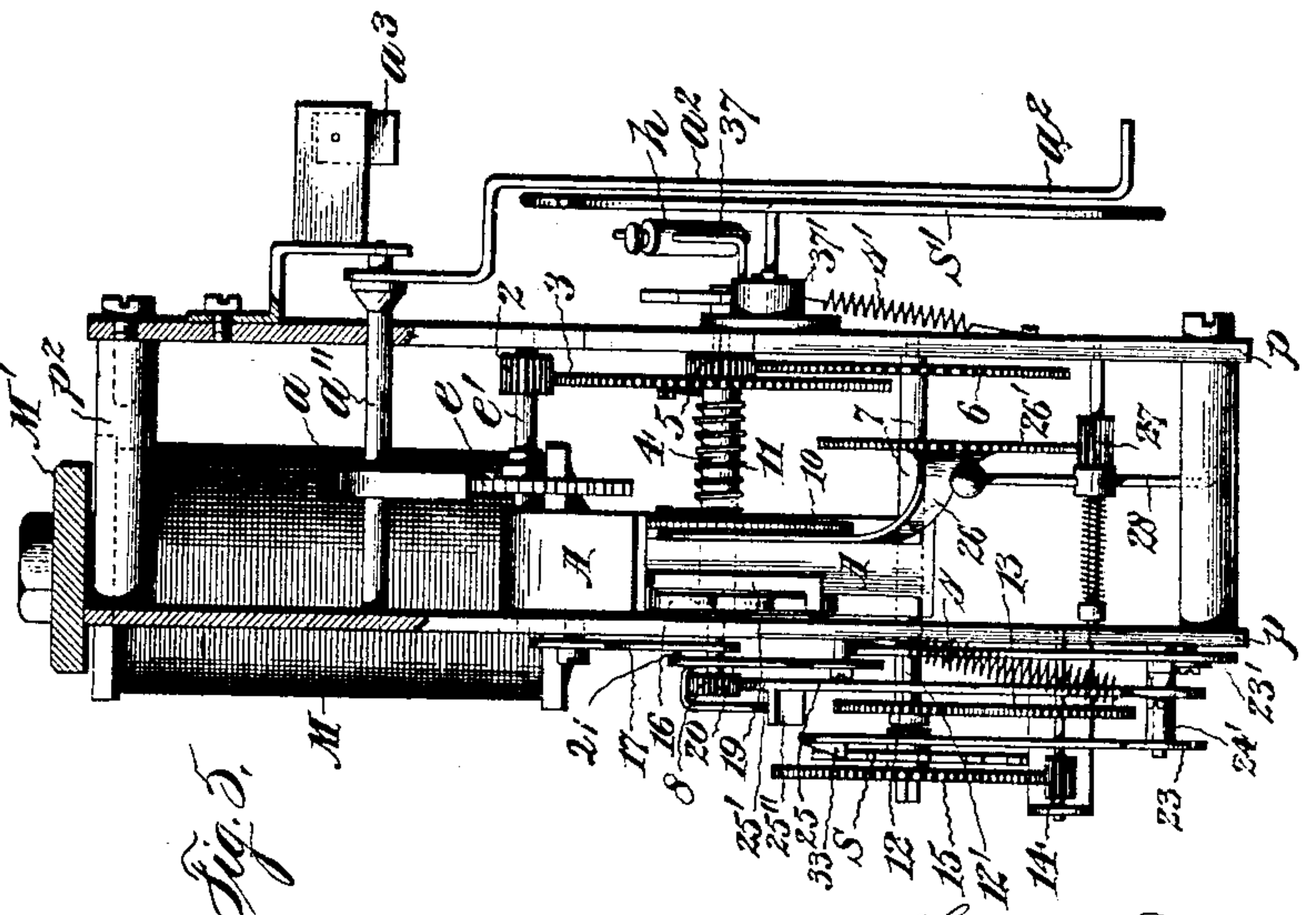


Fig. 5.



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ELECTRIC CLOCK.

(Application filed Dec. 1, 1900.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 15.

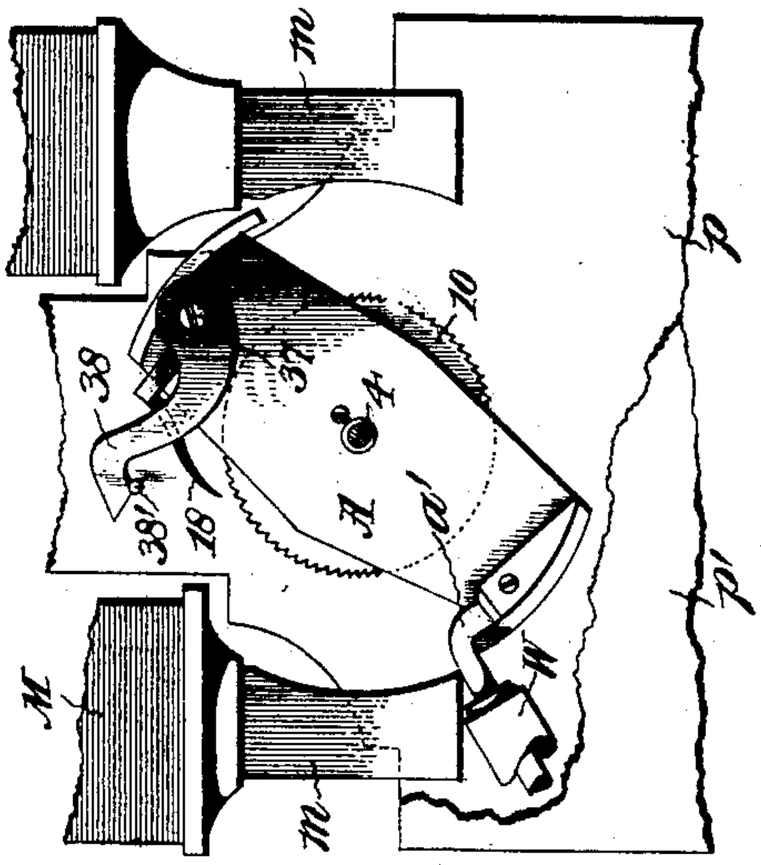


Fig. 13.

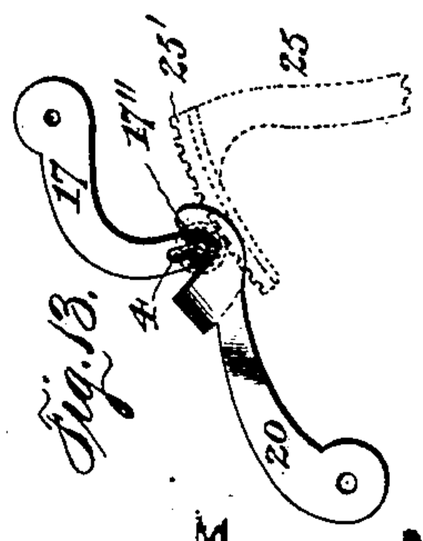


Fig. 8.

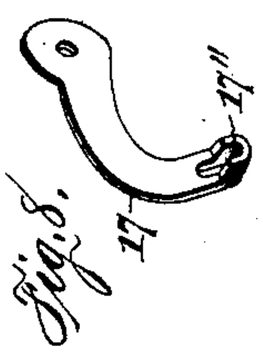


Fig. 11.

Fig. 12.

Fig. 14.

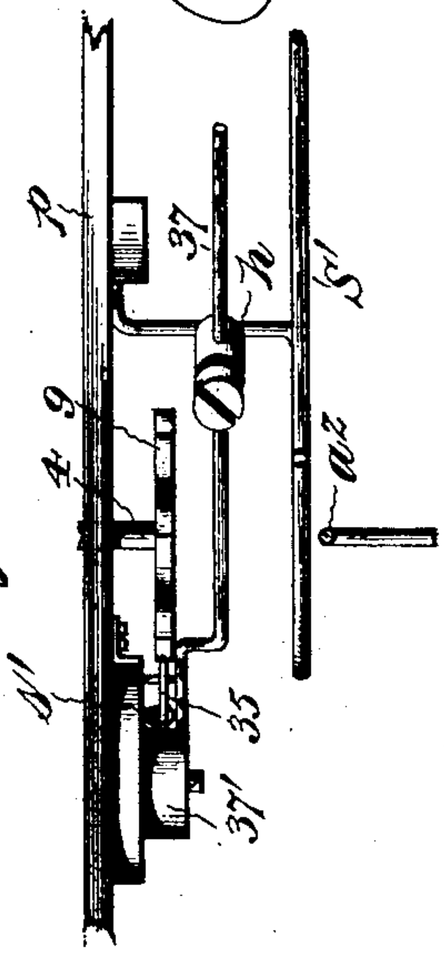


Fig. 9.

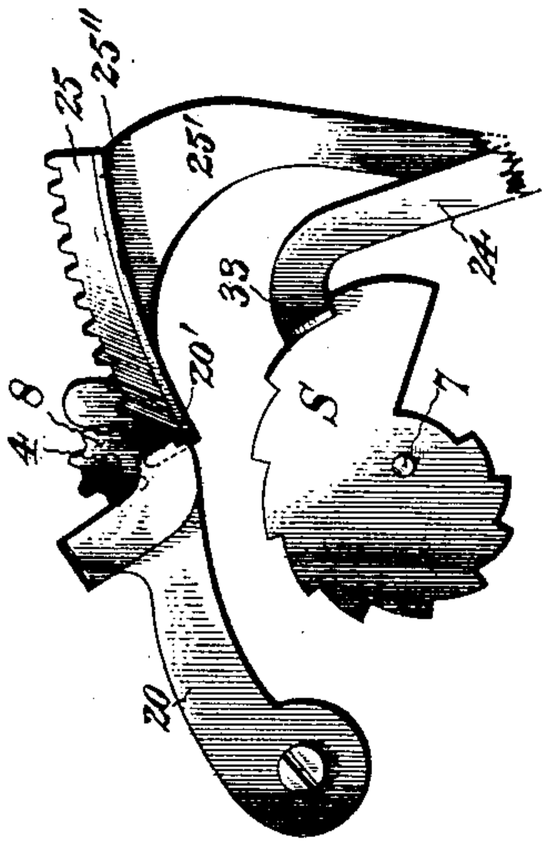
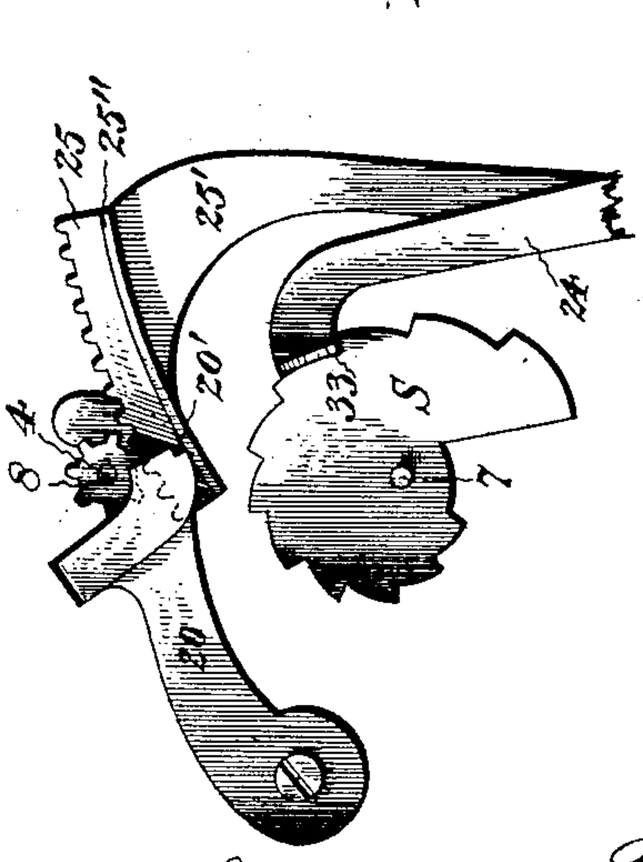


Fig. 10.



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UNITED STATES PATENT OFFICE.

HJALMAR EMANUEL ANDERSSON, OF STOCKHOLM, SWEDEN.

ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 708,112, dated September 2, 1902.

Application filed December 1, 1900. Serial No. 38,344. (No model.)

To all whom it may concern:

Be it known that I, HJALMAR EMANUEL ANDERSSON, a subject of the King of Sweden and Norway, residing at Stockholm, in the Kingdom of Sweden, have invented certain new and useful Improvements in Electrically-Operated Clocks; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

This invention has relation to self-winding clocks wherein the winding up of the mainspring is effected periodically through the agency of electrically-controlled appliances.

The object of my invention lies in the simplification of the winding-up appliances and in combining said appliances with striking mechanism, so as to control the operation of the same.

A further object of my invention resides in a simplified striking mechanism, as will now be fully described, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation of a clock mechanism organized in accordance with my invention. Figs. 2 and 3 are similar views, the front frame-plate being partly broken away, showing the winding and striking appliances in different positions. Fig. 4 is a rear elevation, and Fig. 5 a sectional side elevation, of the clock. Figs. 6 and 7 are fragmentary front elevations, partly in section, with the front frame-plate broken away, illustrating the winding mechanism applied to a clock mechanism of any suitable organization and showing the winding appliances in their different positions. Fig. 8 is a perspective view of the lever 17. Figs. 9 and 10 are fragmentary detail views of parts of the winding and striking appliances. Figs. 11 and 12 are top plan views of parts of said winding and striking appliances, and Fig. 13 is a sectional elevation of parts thereof. Fig. 14 is a top plan view of the hammer-actuating appliances, and Fig. 15 is a detail view illustrating a modification of the devices shown in Figs. 6 and 7.

Referring more particularly to Figs. 1 to 3 and Figs. 4 and 5, p and p' indicate the front and rear frame-plates which carry the operative mechanisms, the upper portion of said plates being attenuated to afford a sufficient space on opposite sides for the support of two electromagnets M, said plates being connected together by spacing-pillars in the usual manner, and said electromagnets M are secured to opposite ends of a bridge M′ at the upper end of said frame-plates, said bridge being supported from the front frame-plate and the spacing-pillar p^2, to which the bridge is secured, or in any other manner. The electromagnets M are included in the electric circuit of an electric generator, as a battery B, and in said circuit is also included a circuit-closer C, of a well-known type, and comprising a cup c, containing mercury connected through a plug c' and wire w with one pole of battery B, and a plunger-contact c^2, the rod c^3 of which is guided in a flange on a bracket c^4, secured to the rear frame-plate p' and supporting the cup c, the downward movement of the plunger being limited by a screw-pin c^5. The upper end of the plunger-rod is bent at right angles to form a laterally-projecting arm c^6 for purposes presently explained. The other pole of the battery B is connected by wire w' with one terminal of one of the electromagnets M, whose opposite terminal is connected by wire w^2 with one terminal of the second electromagnet, the opposite terminal of which is connected by wire w^3 with a conductive stationary part of the clock, as its front or rear frame-plate, for instance, to complete the circuit. When the plunger-contact c^2 is in its lowermost position, Fig. 2, in contact with the mercury, the battery-circuit is closed, and when in its uppermost position, Figs. 1 and 2, said circuit is open. The pole-shoes m of the electromagnets M project from the latter a suitable distance and have in their proximate faces concave recesses, the arcs of which have for center the center of an arbor 4, on which is loosely mounted an oscillating armature A, having convex end faces corresponding with the concave faces of said pole-shoes, said armature being, practically speaking, a two-armed lever.

The escapement-wheel e is secured to an arbor e' and controlled by an anchor a on an

arbor a'', to which is secured the pendulum-fork a^2, and a^3 is the bracket to which the pendulum is hooked or otherwise connected in any usual or desired manner and in which one end of arbor a'' has its bearing. The escapement-arbor e' carries a pinion 2, in gear with a gear-wheel 3, loose on armature-arbor 4, above referred to, and to said gear-wheel 3 is secured a transmitting-pinion 5, in gear with a gear-wheel 6 on the minute-hand arbor 7. To the forward end of armature-arbor 4 is secured a pinion 8 and to its rear end the hammer-actuating wheel 9, as shown in Fig. 4, said armature-arbor also carrying a ratchet-wheel 10, loose thereon, and the main-spring 11, whose terminals are connected with said ratchet-wheel 10 and with the aforesaid gear-wheel 3, which, as above stated, is also loose on said armature-arbor, whereby the power of spring 11 is transmitted to said gear-wheel and therethrough and through the pinion 5 and gear 6 to the minute-hand arbor 7, which latter carries a gear-wheel 12, that not only serves as a transmitting-gear, but also as a let-off cam, to which end said wheel 12 has on its rear face two pins 12′ 12″ for purposes presently explained, and in front of said wheel 12 is secured the usual snail S. The wheel 12 transmits motion to a gear 13, whose arbor has its bearings in a suitable bracket or bridge on the front frame-plate p and carries a pinion 14, in gear with a gear-wheel 15 on the hour-hand sleeve. The armature-arbor 4 also carries a ratchet-wheel 16, rigidly secured thereto, the latter wheel and ratchet-wheel 10 being mounted on opposite sides of the armature A, the former on the front side and the latter on the rear side of said armature, as more clearly shown in Fig. 5.

To the front face of one of the armature-arms is pivoted a lever 17, which has secured thereto a cross or rock bar 17′, carrying at its opposite ends a pawl. The pawl 18 at one end of said rock-bar engages the ratchet-wheel 10, and the hook-pawl 19 engages the ratchet-wheel 16, and it is obvious that when the bar 17′ is rocked by the lever 17 in one direction the pawl 18 is disengaged from ratchet-wheel 10 and the pawl 19 moves into engagement with ratchet-wheel 16, the reverse being the case when the bar 17′ is rocked in an opposite direction. To the other arm of the armature A is secured a rod a', carrying a weight W, adjustably secured thereto by means of a set-screw. The outer end of said arm a' is bifurcated and the branches a^x a^y oscillate in the path of the horizontal arm c^6 at the upper end of the rod c^3 of the plunger-contact c^2 of the circuit-closer C.

To the front frame-plate p is pivoted an arm 20, whose outer upwardly-curved free end is bifurcated and lies normally below the pinion 8 on armature-arbor 4 and when raised will allow said pinion to revolve freely between the branches of its fork and when so raised engages the lever 17 and moves the same in the direction of the pawl 18, thereby disengaging said pawl from its ratchet-wheel 10 and moving pawl 19 into engagement with its ratchet-wheel 16, said lever 17 having a suitably-curved slot in its free end, through which the armature-arbor 4 extends and by which the lever is guided, said slot being of sufficient length to admit of the proper oscillations of the lever. (See also Figs. 8, 11, and 13.) The means for moving the lever 17 in one or the other direction through the arm 20 may be a pin connection 21, Fig. 5, between the two, as shown in Fig. 5, or said lever 17 may have a segmental portion 17″, seating in the correspondingly-curved outer or free end of arm 20, as shown in Figs. 8 and 13, or any other suitable connection may be provided whereby lever 17 is tilted by arm 20 when the latter is swung upwardly.

To a stud 22 on the front frame-plate p is pivoted a two-armed lever 23, whose arm 23′, under the action of a spring s on its arm 23″, is normally held in contact with the minute-hand arbor in the path of the pins 12′ and 12″ on the transmitting-wheel 12, hereinbefore referred to, and to the pivot-pin of the arm 23″ is pivoted an arm 25′, having at its upper end a toothed segment 25, provided with a lateral flange 25″, bearing normally on end of arm 20. To the arm 23″ is also pivoted, but rigidly connected with segment-arm 25′, an arm 24, which when said segment-arm is free to tilt toward the pinion 8 causes arm 24 to drop on snail S. It may here be remarked, and as shown, the pins 12′ and 12″ on wheel 12, although on the same diametral line, are not equidistant from its axis, the pin 12′ being farther from said axis than the pin 12″, for purposes presently explained.

In order to avoid sudden shocks, which would occur by the rapid rotation of the armature A under the action of the weight W on its arm a' or when the armature is suddenly attracted by the electromagnets M, I provide, as shown in Fig. 5, an arm 26, which is secured to the armature and terminates in a toothed sector 26′, in gear with a pinion 27 on an arbor carrying a fly 28, appliances which are well known.

From what has been said it will readily be seen that the usual striking-train is dispensed with and that the striking mechanism is greatly simplified as compared, for instance, with the corresponding mechanism shown and described in Letters Patent of the United States granted to me November 28, 1899, No. 638,160.

The operation of the described mechanism is as follows: Let it be assumed that the time-train is in operation, the armature A and the striking mechanism in the position shown in Fig. 2, with the flange 25″ of the toothed segment 25 bearing on the front branch of the bifurcated end of arm 20. In the position of the armature referred to the electric circuit is open and said armature swings from right to left under the action of the weight W, the

armature-pawl 18 rotating the ratchet-wheel 10, and as this is loose on arbor 4 and connected with one end of the mainspring 11 this is wound up. As the armature A is about to reach the limit of its said oscillation the branch a^x of the forked end of the weighted arm a' impinges on the arm c^6 on plunger-contact rod c^3 and forces the same down into cup c of circuit-closer C, thereby closing the electric circuit and energizing the electromagnets M, which attract the armature A, causing it to swing from left to right back into the position shown in Fig. 1. Under the alternating action of the weighted arm a' of the circuit-closer and the magnetic influence on the pole-shoes of the electromagnets the electric circuit is alternately closed and opened and the time-train kept going, and as the let-off wheel 12 is mounted on the minute-hand arbor they revolve synchronously. Now when at or about at the completion of a revolution of let-off wheel 12 its pin 12′ comes in contact with the face of the free end of the arm 23′ of lever 23 said arm is tilted toward the right, Fig. 2, while the arm 23″ of said lever moves downward against the stress of its spring s, thereby drawing the arms 24 and 25′ downward also. Now it has been stated that these arms 24 and 25′ are loosely mounted on a pin on arm 23″ of lever 23, but are rigidly connected together, as by a sleeve 24′, Fig. 5, also shown in dotted lines in Fig. 2, and it has also been stated that said arms are normally held against swinging toward the arbor 4 and snail S by the abutting of flange 25″ of the toothed segment 25 on arm 25′ against the outer member of the fork at the end of lever 20, the arrangement being such that when the lever 23 draws said arms downward, as above referred to, the aforesaid flange 25″ moves down out of engagement with said lever 20 and both arms swing to the left under their own weight. In this manner the toothed segment is moved under the pinion 8, while the arm 24 drops onto a step of the snail S. As soon, however, as the pin 12′ again clears the lever-arm 23′ the latter again swings toward arbor 7 into the path of pin 12′ under the stress of spring s. This movement of the lever-arm 23′ causes lever-arm 23″ to again lift arms 24 and 25′, thereby bringing the toothed segment 25 into gear with pinion 8, Fig. 3, without thereby moving arm 24 out of contact with the snail S. This upward motion of the toothed segment 25 results in a similar motion of the arm 20 through the flange 25″ on said segment, and as arm 20 is connected with lever 17 the latter will be caused to swing in a substantially upward direction and tilt its rock-bar 17′, so as to move pawl 18 out of engagement with its ratchet-wheel 10 and the pawl 19 into engagement with its ratchet-wheel 16. This takes place when the branch a^x of the forked end of armature-arm a' is about to contact with the contact-rod c^3 and push the same into cup c, and as the movement of the armature is then not antagonized by the motor-spring said armature will complete its oscillation from right to left very rapidly and close the electric circuit, whereby the armature is attracted and caused to swing from left to right and rotate the ratchet-wheel 16. Inasmuch as ratchet-wheel 16 is fast on armature-arbor 4, as is also the hammer-actuating wheel 9, said arbor will be rotated, and wheel 9, acting on an arm 35 on the hammer-boss 37′, raises the hammer-rod 37 against the stress of its spring s' and again releases said rod, causing hammer h to strike the sounding-spring S′, a partial rotation being imparted to armature-arbor at each closure of the electric circuit, which keeps the time-train going. Of course it will be understood that the number of strokes of the hammer depends upon the number of teeth of the segment 25 on the left of pinion 8 or, in other words, on the amplitude of the movement of the segment to the left, Figs. 2 and 3, and this movement is determined by the relative position occupied at the time by the snail S, against a step of which the arm 24 bears and which limits the swing of said segment in the direction named. It is evident, therefore, that at each closure of the electric circuit the ratchet-wheel 16 will receive a progressive motion, causing the hammer to strike its spring, and as the arbor 4 receives a similar progressive or step-by-step rotation through said ratchet-wheel 16 the pinion 8, in gear with segment 25, will move said segment step by step or tooth by tooth toward its normal position until it has moved out of gear therewith and clear of the free end of arm 20, which latter then drops in front of said segment and locks it into its normal position, Fig. 2. In so dropping the arm 20 carries with it the lever 17, whereby bar 17′ is rocked in a direction the reverse of that previously described, thereby moving the pawl 19 out of engagement with its ratchet-wheel 16 and the pawl 18 into engagement with its ratchet 10, the operation of winding the mainspring being resumed, as hereinabove described, until the next hour is struck. If the clock is to strike the half-hour, I make use of the pin 12″, which, as hereinbefore stated, is closer to the axis of wheel 12 than the pin 12′, and as said pin acts on arm 23′ of lever 23 the above-described operations take place; but as said lever-arm 23′ cannot be swung to the right by pin 12″ as far as by pin 12′ the downward movement of segment-arm 25′ is not as great, in fact just sufficient to cause the flange 25″ on said segment 25 to drop into a notch 20′ at the lower edge of the forward branch of the bifurcated end of arm 20, which will allow the segment to swing sufficiently toward the left to cause the first two teeth thereof to engage a tooth of pinion 8 when again raised by the pin 12″ moving out of contact with lever-arm 23′, whereby segment 25 is raised into engagement with said pinion 8. This upward movement of the seg-

ment is also sufficient to swing lever 17 upwardly through arm 20, as hereinbefore described, causing pawl 18 to be disengaged from its ratchet-wheel 10 and pawl 19 to be moved into engagement with its ratchet-wheel 16, whereby the hammer is caused to strike the sounding-spring S′ once, as will be readily understood.

From the above description it will be readily seen that the winding mechanism can be applied to any clock mechanism by simply mounting the two transmitting-gears 3 and 10 loosely on the armature-arbor 4. Such an arrangement I have shown in Figs. 6 and 7, the ratchet-wheel 10 being actuated by pawl 18 on the armature A, loosely mounted on arbor 4, which, as above stated, carries the transmitting-gear 3 and the main or motor spring, said ratchet-wheel 10 and transmitting-gear 3 being loose on arbor 4 and connected to opposite terminals of said spring. In this application of the winding appliances it is of course also of importance to close the electric circuit when the armature A is about to reach the limit of its gravitating movement, and to this end I provide the pawl 18, which is of a resilient metal—*i. e.*, a spring-pawl with an extension 18′ in the path of a pin 36, so located relatively to the pawl extension 18′ that when branch a^2 of fork on end of weighted arm a' of armature A is about to contact with arm c^6 of contact-rod c^3 the said extension will engage said pin 36 and the pawl will thereby be moved out of engagement with the ratchet 10, leaving armature A free to complete its oscillation under the action of its weight and rapidly close the electric circuit, as shown in Fig. 6. The same results are obtained by securing the pawl 18 on a pin 37, that carries a radial arm 38 in the path of a pin 38′, acting on said arm at the proper time, as above stated, and rocking the same to move pawl 18 out of engagement with its ratchet-wheel, as shown in Fig. 15. It will furthermore be understood that these appliances may be used to operate the time-train of a clock or the time and striking trains of a clock and the motive-spring dispensed with. The ratchet-wheel 10 and transmitting-gear 3 would in this case be rigidly mounted on an arbor 4 and the time-train so organized as to compensate for the short period of stoppage during which the armature oscillates in one direction by attraction. The controlling-train—*i. e.*, the pendulum-escapement, &c.—would in this case also be unnecessary.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In a clock, the combination with the arbor carrying the transmitting-gears of the clock-train, a ratchet-wheel and an armature-lever revoluble on said arbor, said lever having one of its arms weighted, a pawl on the other arm thereof in engagement with the aforesaid ratchet-wheel, an electromagnet influencing the lever, and a suitable electric circuit; of a circuit-closer in said circuit operated by the armature-lever to close the electric circuit and rotate the ratchet-wheel during the gravitating movement of the lever, and to again open said circuit when said lever is moved in an opposite direction by the closure of the electric circuit, and means disengaging the pawl from its ratchet-wheel before the armature-lever completes its motion under the action of the weighted arm, for the purpose set forth.

2. In a clock, the combination with the transmitting-gears of the clock-train, a ratchet-wheel, a motor-spring connecting said gears and ratchet-wheel, an armature-lever, an arbor on which said parts are loosely mounted, an electromagnet influencing said lever and a suitable electric circuit one arm of said armature-lever weighted and a pawl on the other arm of said lever engaging the aforesaid ratchet-wheel; of a circuit-closer in said electric circuit operated by the gravitating movement of the armature to close said circuit and rotate the ratchet-wheel and to again open the circuit when said lever is moved in an opposite direction by the previous closure of said circuit and the energizing of the electromagnet, for the purpose set forth.

3. In a clock, the combination with the transmitting-gears of the clock-train, a ratchet-wheel, a motor-spring connecting said gears and ratchet-wheel, an armature-lever, an arbor on which said parts are loosely mounted, an electromagnet influencing said lever and a suitable electric circuit, one arm of said armature-lever weighted and a pawl on the other arm of said lever engaging the aforesaid ratchet-wheel; of a circuit-closer in said electric circuit operated by the gravitating movement of the armature to close said circuit and rotate the ratchet-wheel and to again open the circuit when said lever is moved in an opposite direction by the previous closure of said circuit and the energizing of the electromagnet, and means disengaging the lever-pawl from its ratchet-wheel before said lever completes its gravitating motion, for the purpose set forth.

4. In a clock, the combination with the arbor carrying the hammer-actuating device, a ratchet-wheel secured thereto, an armature-lever loose thereon and having one of its arms weighted, a pawl on its other arm actuating the ratchet-wheel, an electric circuit including an electromagnet influencing the armature-lever, and a circuit-closer acted upon by said lever during its gravitating motion to close the circuit and to open the same again and rotate the ratchet-wheel during its movement in an opposite direction under the influence of the electromagnet energized by the previous closure of said circuit; of a timing mechanism timing the operation of the pawl and operating to disengage the same from its ratchet-wheel in accordance with the number

of blows to be struck by the hammer, for the purpose set forth.

5. In a clock, the combination with the arbor carrying the hammer-actuating device, a ratchet-wheel secured thereto, an armature-lever loose thereon and having one of its arms weighted, a pawl on its other arm actuating the ratchet-wheel, an electric circuit including an electromagnet influencing the armature-lever, and a circuit-closer acted upon by said lever during its gravitating motion to close the circuit and to open the same again and rotate the ratchet-wheel during its movement in an opposite direction under the influence of the electromagnet energized by the previous closure of said circuit; of a let-off cam, a snail, and mechanism controlled thereby and operating to disengage the aforesaid pawl from its ratchet-wheel in accordance with the number of blows to be struck by the hammer, for the purpose set forth.

6. In a clock, the combination with the arbor carrying the hammer-actuating device, transmitting-gearing, a ratchet-wheel 10 and an armature-lever loose on said arbor, a ratchet-wheel 16 fast thereon, a motor-spring connecting ratchet-wheel 10 with the transmitting-gearing, two pawls carried by one arm of the armature-lever whose other arm is weighted, one of said pawls normally engaging ratchet-wheel 10 and the other held normally out of engagement with ratchet-wheel 16, an electric circuit including an electromagnet for aforesaid armature-lever, and a circuit-closer operated by the lever during its gravitating motion to close the electric circuit and to again open the same during its motion in a reverse direction under magnetic influence; of a timing mechanism, means controlled thereby to throw the pawl of ratchet-wheel 10 out of, and the pawl of ratchet-wheel 16 into engagement, and to time the operation of the latter in accordance with the number of blows to be struck by the hammer, for the purpose set forth.

7. The combination with the arbor 4 carrying the pinion 8, hammer-actuating wheel 9 and the ratchet-wheel 10, an electric circuit including an electromagnet and a circuit-closer, an armature-lever loose on said arbor 4 and carrying on one of its arms a pawl in engagement with said ratchet-wheel 10, the other arm of said lever weighted and operating the circuit-closer during its gravitating movement to close the electric circuit and to open the same during its reverse movement under magnetic influence; of a let-off device a snail, the lever 26 in the path of the let-off device, the arms 24 and 25′ the latter carrying the toothed and flanged segments 25, said arms 24 and 25′ loosely pivoted to an arm 23″ of lever 23, the free end of arm 24 in the path of pinion 8 on aforesaid arbor 4, the arm 20 having its outer end bifurcated and extending under said pinion 8 and forming an abutment for segment 25, and means controlled by arm 20 to move the pawl of ratchet-wheel 16 out of engagement therewith whenever segment 25 is moved out of gear with and by pinion 8, for the purpose set forth.

8. The combination with the oscillating armature-lever, a rock-lever mounted on one of its arms, a pawl rocked by said lever, the arbor 4, the ratchet-wheel 16, the pinion 8 and the hammer-actuating wheel fast on said arbor; of the arm 20 and mechanism substantially such as described controlling the movements of said arm to periodically lift and lower the same, and a connection between said arm and the aforesaid rock-lever, whereby the pawl is moved periodically into and out of engagement with its ratchet to revolve arbor 4, for the purpose set forth.

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

HJALMAR EMANUEL ANDERSSON.

Witnesses:

L. KALLENBERG,

A. NORDBLOM.