

No. 772,002.

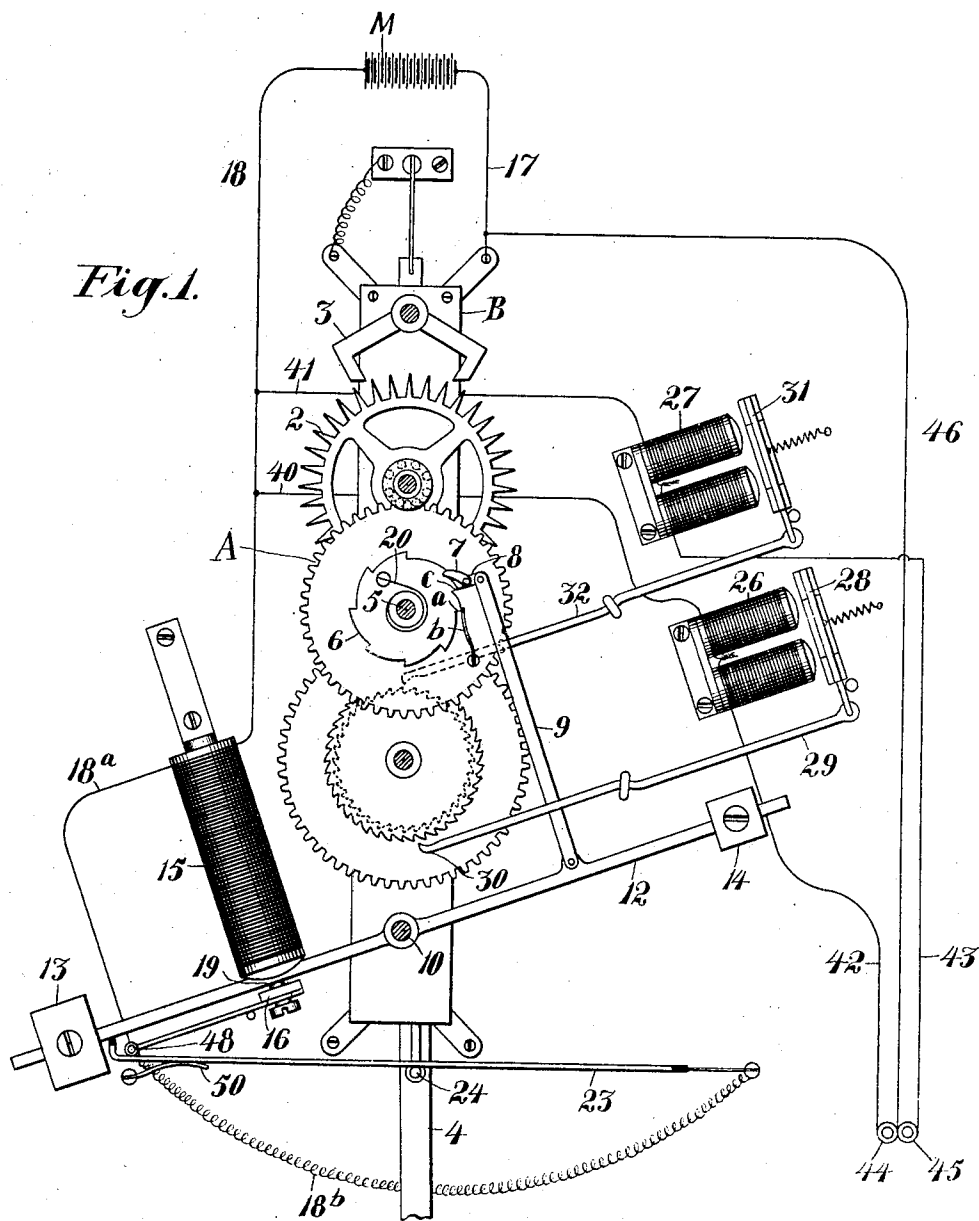
PATENTED OCT. 11, 1904.

T. A. SCHLUETER.  
ELECTRIC CLOCK.

APPLICATION FILED FEB. 7, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses:  
F. C. Fiedner  
J. H. Fiedner

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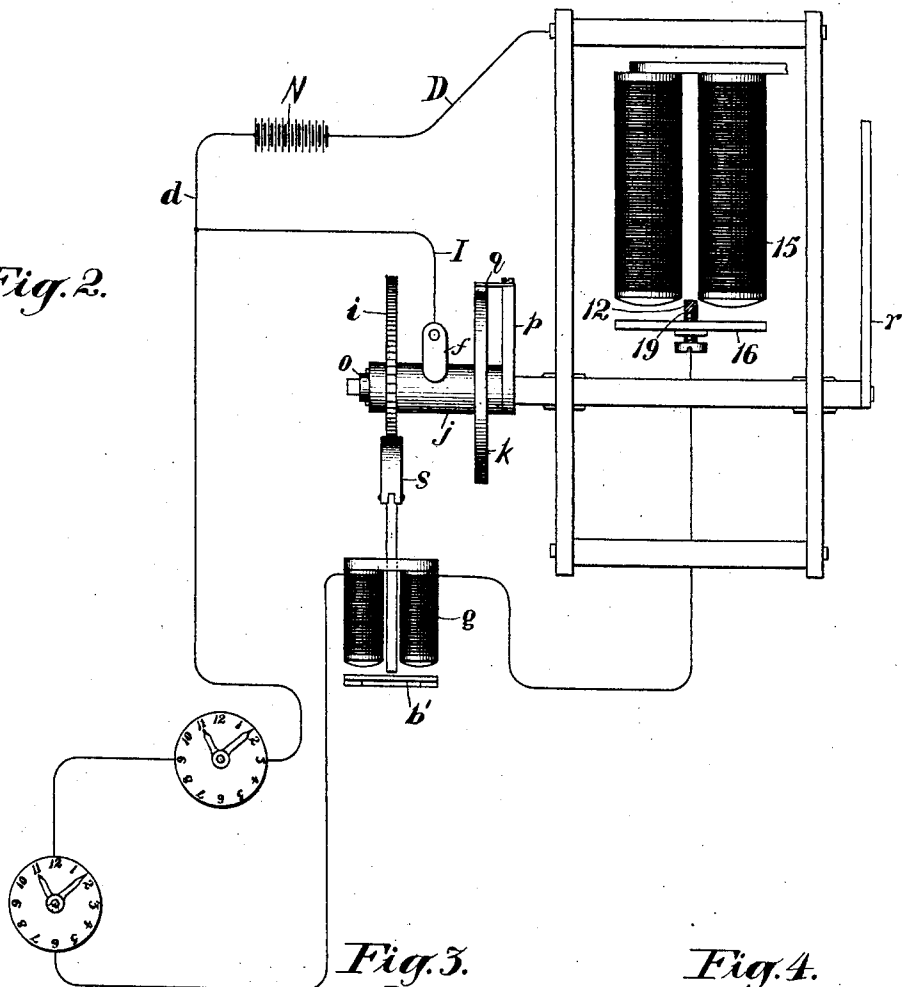
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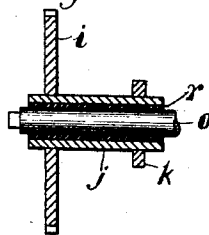
NO MODEL.

2 SHEETS—SHEET 2.

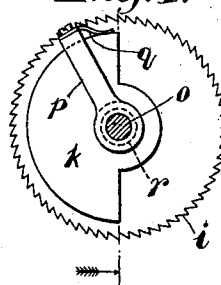
*Fig. 2.*



*Fig. 3.*



*Fig. 4.*



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# UNITED STATES PATENT OFFICE.

THEODORE A. SCHLUETER, OF OAKLAND, CALIFORNIA.

## ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 772,002, dated October 11, 1904.

Application filed February 7, 1903. Serial No. 142,257. (No model.)

*To all whom it may concern:*

Be it known that I, THEODORE A. SCHLUETER, a citizen of the United States, residing in Oakland, county of Alameda, State of California, have invented an Improvement in Electric Clocks; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to devices for operating a clock or clocks which may be hung in such places as to be readily seen and where it would be difficult to reach to wind or set.

It often happens that in large offices or stores clocks would be hung high were it not for the fact that they have to be wound every week or set occasionally. Again—as, for instance, in factories or schools—it is very desirable to have subclocks in different rooms that would keep the same time exactly as the master-clock and when the master-clock is set forward or backward would not necessitate the setting of the subclocks. These subclocks by the working of my invention may also be hung anywhere, inasmuch as they do not have to be set or wound.

My invention comprises details and constructions which enable me to accomplish the above objects.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a front view of the master-clock mechanism. Fig. 2 shows the combination with the subclocks. Fig. 3 is a section, and Fig. 4 is a side view, of the ratchet-wheel.

It is the object of my invention to provide a means for actuating a clock mechanism and the escapement thereof by means of weights mounted upon a fulcrumed lever and so counterbalanced that one is sufficiently heavier than the other to actuate the escapement and to use the momentum of the two weights to give a greater radius of action.

As shown in the present construction, A represents the usual or any suitable clock mechanism having an escapement-wheel 2 and the pallets 3, engaging the teeth of the escapement-wheel.

4 is a pendulum-rod the motion of which is continued by the action of the escapement-

wheel upon the pallets under the pressure of a weight or spring.

In the present construction I have shown the device as actuated by the difference between two weights acting through a counter-shaft 5 and gear-wheel which engages the pinion upon the escapement-wheel shaft in the usual manner. Upon this counter-shaft 5 is a toothed or ratchet wheel 6, which is engaged by a pawl 7, mounted upon a stud or arm 8. This stud or arm 8 is connected with an oscillating lever 12 by a rod 9 either directly or in other suitable manner. In the present case it is shown as connected directly with the lever 12, so that when the lever is drawn down the pawl will move freely over the teeth of the ratchet-wheel 6, and when the lever is pushed up by the momentum of the two weights carried by it the pawl will engage with these teeth and will thus push the wheel around with whatever pressure may be applied to the lever and pawl, and the escapement is thus caused to act in a manner usual to such devices. In order to actuate this lever and pawl periodically, I have shown the lever-arm 12 fulcrumed on the shaft 10, and it extends approximately horizontal to a considerable distance in each direction. Upon the ends of this lever are mounted weights 13 and 14. The actuating-weight 13 is made sufficiently heavier than the weight 14 to insure its operating the escapement either by being actually heavier or by fulcruming the lever 12 at such a point that the weights 13 will be upon the long arm of the lever. By suitable screw or other adjusting means the position of the weights upon the lever can be changed until they bear the proper relation to each other. The lever 12 being tilted upon its fulcrum, so as to raise the weight 13, and then released, this lever 12 will act through the connecting-rod, pawl, and ratchet to move the escapement and cause the pendulum to swing.

I do not claim, broadly, the use of a tilting lever weighted on one end in connection with electrical devices necessary to tilt same.

Other electrical clocks invented also have tilting levers with the weight on one end, which actuates the escapement through a ratchet, pawl, connecting-rod, &c.; but in my

invention I use a weight on either end of a fulcrumed lever, as described, and use the difference between the two weights as power to drive the escapement and utilize the momentum of both weights to give the lever a much greater radius of action. In practice it is found that the actual power necessary to drive the clock is very small. Now by means of the adjusting-screws the weights are so regulated that weight 13 slightly overbalances weight 14, and the momentum of both weights when receiving the impulse by action of the electromagnet will cause the fulcrum-lever 12 to tilt in a much greater degree than it would if simply a smaller weight were put on one end, as is usually done, because the weights 13 and 14 may be many times heavier than such weight on one arm of the lever, as would be necessary to drive the clock. In order to tilt this lever 12 and raise the weight 13 and simultaneously lower weight 14 at stated intervals, I have shown an electromagnet 15 having an armature 16. The electromagnet is energized by any suitable battery connections. In practice it is found that an electromagnet loses its attractive force very considerably if the armature is any great distance from its poles and that the attractive force increases greatly as the armature approaches its poles.

In the present construction lever 12 passes between the two coils of the electromagnet 15 and is so disposed that it may rise or fall at will above armature 16, as shown. Point 19 makes contact with fulcrum-lever 12 when electromagnet 15 is energized, being in line beneath said lever 12. When the electric circuit is completed, armature 16 is attracted and tilts the lever 12 quite forcibly, inasmuch as the entire attractive power of the magnet is utilized. The increased attractive force as armature approaches the poles causes the two weights to receive considerable momentum, which, as before explained, causes the lever 12 to tilt very considerably (the momentum of both weights acting in unison for this purpose) after the movement of the armature 16 has ceased, which movement in itself is comparatively slight. The armature 16 is naturally kept at the desired distance from the pole by spring or any other suitable means.

One of the wires, 17, of the battery connects with the clock-frame B and the other wire, 18, connects with the electromagnet 15. The wire 18<sup>a</sup> continues the electrical communication from the electromagnet to the pivot 48 of the arm holding the armature 16. Now by following the electrical connections it can be readily seen that the current would flow through wire 17 to clock-frame B, through the clock-frame and pivot 10, and along the lever-arm 12 to contact-point 19, armature 16, to the pivot 48, thence through wire 18<sup>a</sup> and through the electromagnet 15 and along the wire 18 to the other pole of the battery

M, when the lever-arm 12 is at the lowest point of action, or, in other words, when point 19 and lever-arm 12 are in contact. When this takes place, as previously described, the armature 16 is attracted and the lever-arm 12 tilted. The moment the lever-arm 12 leaves contact-point 19 the electrical communication is broken, causing the electromagnet to lose its attractive power, and armature 16 falls back to its original position. Consequently the electrical current flows only while the armature 16 travels toward the poles, which, it is evident, consumes but a fraction of a second. This arrangement therefore takes but very little of the battery force.

It is understood that pivot 48, and consequently armature 16 and contact-point 19, are insulated from the clock-frame.

Experience in electrical apparatus has been that contact-points become burned or oxidized after a time, requiring scraping or cleaning to make perfect electrical connections. My own experience in connection with electrical clocks has been the same. It is evident that in the latter the contact-points must remain bright and clean in order that perfect electrical communication can be had at all times. Otherwise the clock would stop.

To obviate the possibility of the clock stopping by reason of burned, oxidized, or imperfect electrical contacts, in my invention I use, first, the entire attractive force of the magnet to make a good hard contact, as would naturally occur between point 19 and lever-arm 12 when armature 16 is attracted. Now even should contact-point 19 fail by reason of the continued accumulation of oxidized metal or from any other reason, which experience has proven will occur in a few months, I provide an auxiliary sliding or wiping contact, which makes a complete electrical circuit independent of the connection between contact-point 19 and lever 12. This consists of an arm 23 so mounted that it would be depressed by reason of the falling of weight 13. In the present construction it is shown as being in line beneath lever-arm 12 and in contact with pin 24. The pin or contact 24 is carried by the swinging of the pendulum, so as to move just beneath the arm 23 and out of contact with it during all the time the weight 13 is gradually descending and weight 14 ascending until at or about the instant when contact is made between lever-arm 12 and point 19. Then this pin or contact 24 will have also made connection with arm 23. The pendulum and pin 24 are electrically connected to clock-frame B.

By referring to Fig. 1 it will be seen that the electric current would flow from clock-frame B to contact 24, to arm 23, and thence to wire 18<sup>a</sup>, and thus complete the electrical connections should contact at 19 fail. When this electrical connection takes place, armature 16 is attracted, lever 12 receives its impulse,

and consequently arm 23 by reason of the spring 50 rises, and the connection between arm 23 and pin 24 is broken, but no spark produced because of the current being continued through point 19 and lever-arm 12 until motion of armature 16 is completed. Contact-point 19 may have failed at first; but by reason of the attractive force of the electromagnet and the slight friction between point 19 and lever-arm 12 by the time the contact is broken at pin 24 a good contact will be made between lever-arm 12 and contact 19, which, as explained before, continues the flow of current until the motion of armature 16 is completed. From the fact that no spark is produced at the arm 23 and point 24 and that it is a sliding or wipe contact it will always remain bright and clean. This I consider a very important point, as good clean electrical connections are necessary to the continued running of the clock, and an electric clock which would not run continuously would have no commercial value. As soon as the weight 13 has been raised to its highest point and the pawl 7 engaged with the toothed ratchet 6, through which motion is communicated, the weight instantly commences to act again upon the escapement until it has dropped to the point where the electrical circuit is again completed. In this manner as long as the battery is in operation the weights will be periodically moved and the clock will continue to operate.

In order to insure continuous movement of clock-train during the short interval while the weight is being raised and the pawl 7 is moving over the ratchet for a new engagement, I employ a small coiled spring 20, which presses upon the counter-shaft, while the spring-pawl *b* holds ratchet-wheel in check, and thus keeps it in motion during the interval while the pawl is moving to make a new engagement with the ratchet-wheel. When the clock is set at some considerable distance and out of convenient reach, it is desirable to have some means for setting it in case it is running too fast or too slow. This I effect by means of electromagnets 26 and 27. The magnet 26 has its armature 28 fulcrumed or otherwise conveniently connected, so as to be moved when an electrical circuit is completed and the magnet energized. I have here shown the armature as fulcrumed at one end and having an extension-rod from the other end of sufficient length to give it the required motion. With this is connected a rod 29, which actuates a pawl 30, so that when the magnet is energized and the armature attracted this pawl, engaging with the ratchet-wheel carried upon the shaft of the minute-hand, acts to turn the shaft, and with it the hand forward or backward, according to whether the pawl engages the ratchet above or below the shaft. In the present case it is shown in such a way that it would move the hand forward. The other magnet, 27, has an armature 31,

which is correspondingly actuated by the energizing of its magnet, and this armature has connected with it a rod 32, which rod actuates a pawl operating upon an oppositely-acting ratchet and acting to move the minute-hand in the opposite direction to the first-named magnet. Thus one of these magnets when energized acts to set the hand forward and the other to set it back by small impulses, which depend upon the size of the ratchet-teeth and the distance of movement of the armature and the intermediate parts. These electromagnets may be energized by the pressure of buttons similar to those used for actuating electrical gas-lighting devices, and these may be located at any convenient point. Thus the clock may hang upon a wall fifteen or twenty feet above the floor, and after the clock is fairly regulated by the use of these buttons any small discrepancies in the time can be corrected.

The electrical circuits are as follows: The wire 17 from battery M connects with the clock-frame B and thence through lever 12. The wire 18 connects with the electromagnet 15. Thence the current passes through wire 18<sup>a</sup> to pivot or fulcrum of armature 16, thence by wire 18<sup>b</sup> to pivot of the wiper-arm 23, so that when contact is made at point 19 or between arm 23 and pin 24 an electric circuit is completed and the electromagnet energized. All pivoted joints or journals may be bridged with fine flexible wire to insure perfect electrical connection.

The circuits for the setting mechanism are as follows: from battery M, through wire 18 and by branch wires 40 and 41, to the electromagnets 26 and 27, respectively, thence by wires 42 and 43 to push-buttons 44 and 45, respectively. When either of these buttons is depressed, circuit is completed through wire 46, which returns to wire 17 and to battery, thus completing the circuit and energizing the magnet 26 or 27 controlled by the particular button which has been depressed.

Referring to Fig. 1, it will be seen that the ratchet-wheel 6 has at one place two teeth occupying approximately the same space that in the rest of the circumference is occupied by one. The tooth *a* is set just so far back that the spring-pawl *b* rests on top of tooth *a* instead of springing into place just before the time the lever-arm 12 has descended far enough to make electrical contact at point 19, (or should it fail then at wipe-contact 24.) For all the other teeth the spring *b* would fall into place to hold the ratchet-wheel stationary while the pawl 7 is moving back to engage the following tooth. When these double teeth occur when the contact is made and the electromagnet causes the lever-arm 12 to tilt, the ratchet will follow the pawl 7 backward by reason of the tension of the spring 20 until the spring-pawl *b* engages tooth *a*. Thus it will be seen that if the other teeth of ratchet-wheel are one minute apart in this

instance we will have two contacts at point 19 in one minute. Now by employing a separate set of batteries N from those which drive the clock and connecting one wire, D, therefrom to the clock-frame and the other wire, d, through the electromagnets of one or more subclocks and then through the electromagnet g and then to the pivot-carrying armature 16 we have a complete electric circuit when contact is made between contact-point 19 and lever-arm 12. The lever-arm 12 is shown in cross-section in Fig. 2 without weights. As previously described, this takes place every minute during a complete revolution of the ratchet-wheel 6 except where the teeth a and c occur, when it will be twice a minute. By having the electromagnet g in circuit it is energized and attracts its armature b', and thus moves ratchet-wheel i one tooth by suitably-connected pawl and ratchet at each contact at contact-point 19. The ratchet-wheel i has sixty teeth. It will be seen that normally it would travel faster than one revolution per hour, inasmuch as we have an extra tooth in ratchet 6 and two contacts per minute, as previously described. The ratchet-wheel i is electrically and mechanically connected by the metallic sleeve j with the half-circular segmental flange k. The ratchet-wheel i and sleeve j and flange k are loosely mounted on the minute-hand shaft by an insulating-sleeve, and thus are not in electrical contact with the clock-train. Ratchet-wheel i, sleeve j, and flange k are connected by wire I and frictional contact-spring f' with wire d, leading from the battery N. The minute-hand shaft o has a projecting arm p surmounted by a contact-spring q. Now when contact is made at point 19 electromagnet g is energized, as well as the electromagnets of subclocks in circuit, and ratchet-wheel i is moved forward one tooth, or one-sixtieth of a revolution, as well as the minute-hands of the subclocks; but by reason of the extra tooth in ratchet-wheel 6, as previously described, the ratchet-wheel i, and consequently the flange k, will move faster than arm p, connected with minute-hand shaft of the clock-train, and will continue to do so until flange k makes electrical connection with arm p and clock-train through contact-spring q. When this contact takes place, the electric current passes from battery N through wire D to clock-frame, through arm p, spring q to flange k, to sleeve j, and spring f' through wire l to wire d to the other pole of battery N and in consequence does not pass through subclocks and electromagnet g sufficiently to energize same. In consequence the flange k and subclocks remain stationary until the arm p has advanced far enough to break electrical connection with flange k by reason of the movement of the minute-hand shaft o of clock-train. Thus the subclocks and ratchet-wheel i will move no faster and keep perfect time with master-clock, to which arm p is attached.

Should the hand r be moved forward up to thirty minutes, the subclocks will automatically set themselves by reason of the faster movement of flange k than the arm p, as previously described, until electrical contact is again made at contact-spring q, as previously described. Should the hand r be moved backward, the spring q will make contact with flange k and short-circuit battery, as shown in Fig. 3, causing subclocks and flange k to remain stationary until contact is broken at spring q by reason of the forward movement of the arm p, which is attached to minute-hand shaft o, as previously described. Thus it will be seen that the master-clock may be set backward or forward up to thirty minutes, and the subclocks will automatically set themselves. The minute-hand shaft o is frictionally connected with clock-train, as is usual in clocks. Armature b' of electromagnet g does not act on ratchet-wheel i until about the close of its upward movement, so as to insure a sufficient flow of current to subclocks to move hands forward one minute before spring q might short-circuit battery. The momentum of armature b' is sufficient to actuate the pawl s on ratchet-wheel i to move it forward one notch should spring q short-circuit battery at the moment of forward movement of ratchet-wheel i.

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

1. A clock of the character described having in combination an electromagnet and an armature therefor, a lever fulcrumed midway between its ends, a weight upon the end of the lever farthest from the armature, a second weight upon the opposite end of the lever and heavier than the first-named weight, said arm of the lever carrying the heavier weight contacting with the armature when depressed and adapted to be lifted by the attraction of the armature whereby the unequal weights coact to continue the movement of said lever freely and independent of the clock mechanism after the impulse of the armature has ceased, mechanism by which the magnet is energized, a pawl connected to the arm of the lever most removed from the armature, and a ratchet-wheel with which the pawl engages when the heavier end of the lever reaches its highest point whereby the differential of the two weights is employed to drive the ratchet-wheel and to return the heavier end of the lever into contact with the armature.

2. A clock of the character described having in combination a tilting escapement-actuating lever pivoted midway of its ends, an electro U-magnet between the legs of which one arm of the lever is movable, an armature with which the lever-arm contacts when depressed, electrical contacts carried by the lever-arm and the armature, through which the magnet is energized and the lever thrown up

by the movement of the armature, weights upon opposite sides of the pivotal center of the lever said weight on the armature end of the lever being heavier than the weight on the opposite end of said lever and said weights acting in unison to continue the movement of the lever beyond that of the armature, and the differential of the weights acting to directly drive the escapement and to depress the lever into contact with the armature.

3. The combination in a clock of a lever fulcrumed to tilt in a vertical plane, an electromagnet with its axis parallel, and contiguous to said plane, an armature to which one end of the lever approaches when depressed, contacts carried by the lever and the armature, said contacts acting to complete an electrical circuit and energize the magnet to attract the armature, unequal weights upon opposite ends of the lever acting in unison to continue the movement of the lever beyond that of the armature, a link connected with the lever and a pawl carried by the link, a ratchet through which the escapement is actuated and with which the pawl engages after the lever has reached the end of its throw whereby the difference between the lever-weights acts directly to impel the escapement.

4. The combination in a clock of a tilting weighted escapement-actuating lever, an electromagnet and armature, contact-points carried by the lever and the armature whereby the magnet is energized, the armature attracted, the lever tilted, and the contact broken, and a second slidable or wipe contact and electrical connections whereby the magnet is energized if the first contacts fail to act.

5. The combination in a clock of a lever fulcrumed to tilt in a vertical plane and having unequal weights upon opposite sides of the fulcrum, an electromagnet contiguous to the heavier end of the lever and parallel with its plane of motion, an armature, contacts carried by the lever and armature whereby the magnet is energized when the lever-arm is depressed to rest upon the armature, a ratchet-wheel through which motion is transmitted to the clock-escapement, a pawl connected with the lever and freely movable over the ratchet when the lever is thrown up by the movement of the armature, and engaging the ratchet when the weight again acts, a supplemental pawl engaging the ratchet while the main pawl is disengaged therefrom and a coiled spring upon the counter-shaft and connected with the ratchet to continue its motion while the first-named pawl is disengaged.

6. The combination in a clock of a weighted escapement-actuating lever having unequal weights upon opposite ends, an electromagnet and armature, contact-points carried by the lever and the armature respectively, a second sliding contact and means for completing an electrical circuit to energize the magnet, one arm of said contact being connected and mov-

able with the pendulum and the other actuated by the movement of the weighted lever to complete the second circuit approximately in unison with the completion of the first circuit.

7. The combination in a clock of a centrally-fulcrumed lever having unequal weights at opposite ends, an electromagnet and an armature therefor having its plane of movement coincident with that of the lever, contact-points carried by the lever and the armature through which an electrical circuit is completed and the magnet energized when the end of the lever approaches the armature, said lever having an amplitude of movement greater than that of the armature, a pawl actuated by the lever, a ratchet mounted upon a shaft through which motion is transmitted to the escapement-wheel, and over which ratchet the pawl moves during the upward movement of the lever, said pawl engaging the ratchet upon the return movement of the lever, and a device consisting of a supplemental pawl engaging the ratchet when the first-named pawl is out of engagement, a coiled spring upon the ratchet-shaft, having its outer end connected with the ratchet and acting to continue the movement of the ratchet while the main pawl is out of engagement.

8. The combination with a master-clock and connected subclocks of a fulcrumed lever having unequal weights at opposite ends, an electromagnet parallel with the plane of oscillation of the lever, an armature, contacts carried by the lever and the armature through which the magnet is energized to throw the lever upward, a pawl carried by the lever, a ratchet through which the clock is actuated and which is engaged by the pawl at the end of the upward movement of said pawl, said ratchet having one of its tooth-spaces provided with two teeth and mechanism whereby connected clocks are maintained thereby in unison with the master-clock.

9. The combination with a master-clock of a fulcrumed lever having unequal weights upon opposite ends, a magnet and armature, electrical contacts carried by the lever and armature, a pawl carried by the lever, a ratchet through which the clock mechanism is driven and with which the pawl engages, said ratchet having two teeth formed in one of its main tooth-spaces, a subclock having a minute-hand, a battery, electromagnet, and mechanism through which the minute-hand of the subclock is driven in unison with the movements of the master-clock, and a switch by which the electromagnet of the subclock is cut out to maintain said clock in unison with the main clock.

10. The combination in an electrically-actuated clock, of subclocks, battery and electromagnet pawl and ratchet actuated thereby and communicating motion to the subclocks, of a ratchet-wheel by which the master-clock is driven, said ratchet having two teeth in one of

the main tooth-spaces, an electrical circuit intermittently completed to advance the minute-hands of the clock, and a switch by which the circuit actuating the subclocks is cut in or  
5 out, to maintain all the clocks in unison.

11. The combination with electrically-actuated main and sub clocks, said main clock having a shaft and minute-hand, of a sleeve insulated from and turnable upon the minute-  
10 hand shaft of the main clock, electrically-actuated mechanism by which it is advanced faster than said minute-hand and a switch movable in unison with the sleeve, and acting to advance or retard the subclocks and maintain  
15 them in unison with the master-clock.

12. The combination with electrically-actuated main and sub clocks, said main clock including a shaft and minute-hand, of a centrally - fulcrumed lever, having unequal  
20 weights at opposite ends, an electromagnet and an armature therefor and means whereby the lever is thrown up by the movement of the armature, a pawl carried by the lever, a ratchet-wheel with which it engages and through  
25 which the escapement is actuated, said ratchet having two teeth in one of its tooth-spaces, an independent battery and connections with the main armature whereby the subclocks are actuated in unison with the main one, a ratchet-  
30 wheel and segment turnable upon the minute-hand shaft of the main clock and insulated therefrom, an arm carried by the minute-hand shaft and capable of contact with the segment, and a short-circuit connection between the seg-  
35 ment and the battery.

13. The combination with electrically-actuated main and sub clocks and connections as described, said main clock including a shaft and minute-hand, of a sleeve insulated from and turnable upon the main-clock minute-  
40 hand shaft, electrically-actuated mechanism by which said sleeve is moved at a different speed than the minute-hand, an adjusting mechanism, and a switch movable in unison with the sleeve, said mechanism acting to ad-  
45 vance or retard the clocks and maintain them in unison.

14. The combination with a tilting weighted lever, an electromagnet and armature by which the weight is periodically raised and  
50 connected to actuate a clock mechanism, subclocks and independent actuating-battery and connections with the main armature whereby the subclocks are actuated in unison with the main one, of a ratchet-wheel and segment  
55 turnable upon the minute-hand shaft, and insulated therefrom, an arm carried by the minute-hand shaft, and capable of contact with the segment, and a ratchet-wheel through which motion is transmitted to the main clock,  
60 said ratchet having two teeth in the space of one at one point in its circumference, whereby the subclocks are regulated in unison with the main one.

In witness whereof I have hereunto set my  
65 hand.

THEODORE A. SCHLUETER.

Witnesses:

S. H. NOURSE,

JESSIE C. BRODIE.