No. 754,622. PATENTED MAR. 15, 1904.

D. W. THOMPSON.

ELECTRIC CLOCK.

APPLICATION FILED DEC. 5, 1895.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1

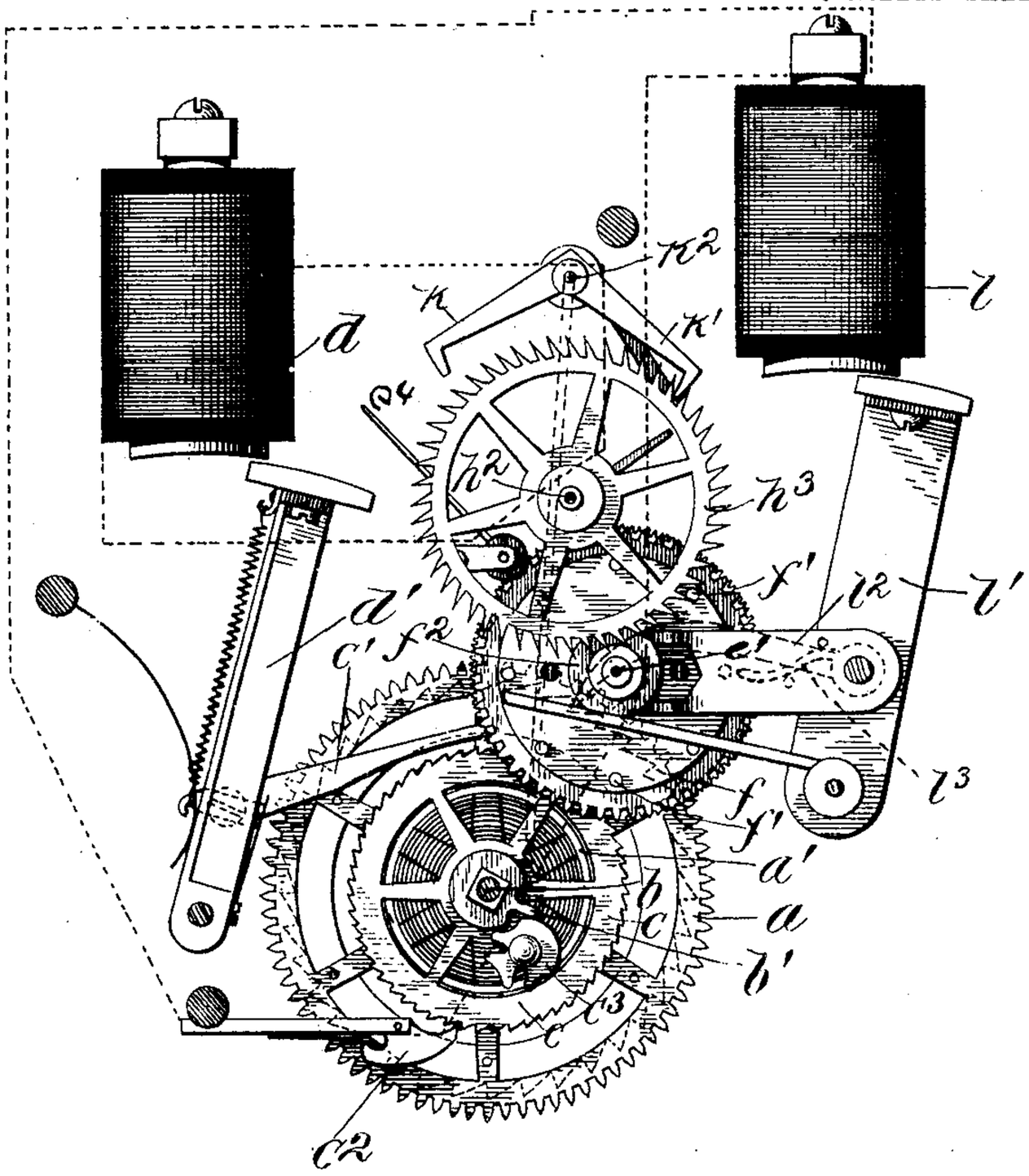
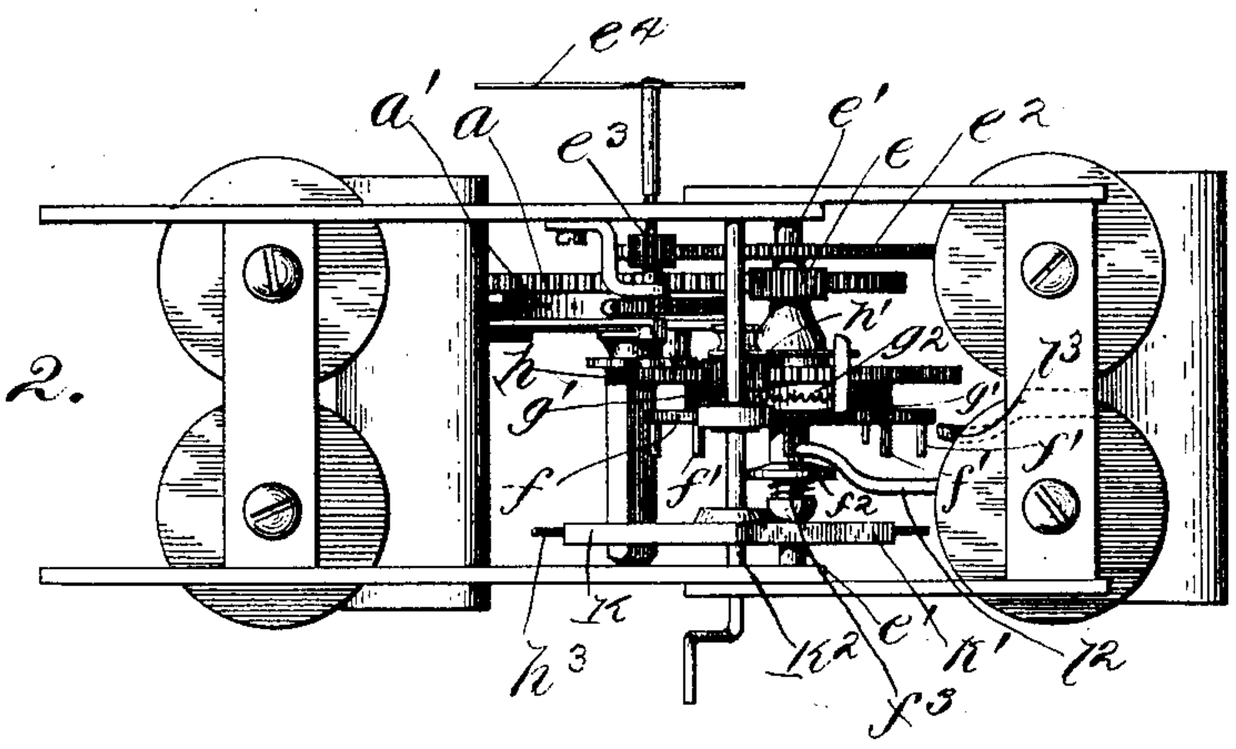


Fig. 2.



Witnesses:
Le Roy C. Garner.
W. Clyde Jones.

Inventor:
David W. Thompson,
By Barton & Brown,
Attorneys.

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NO MODEL. 3 SHEETS—SHEET 2.

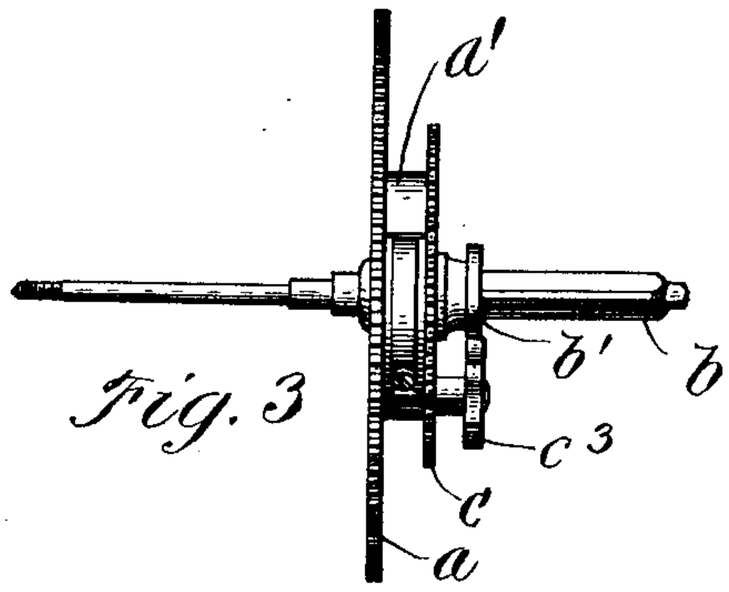

Fig. 3

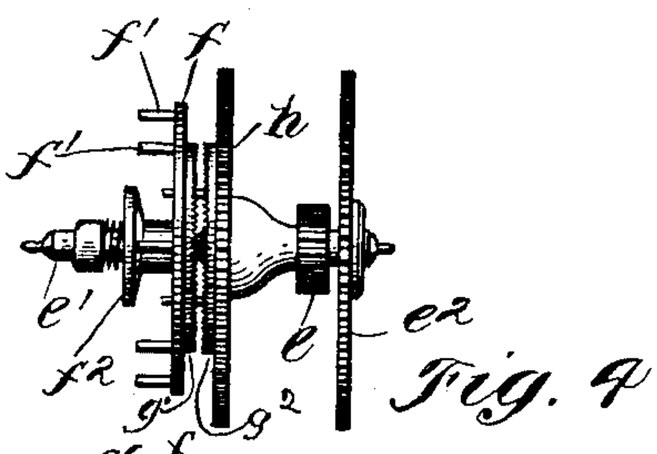

Fig. 4

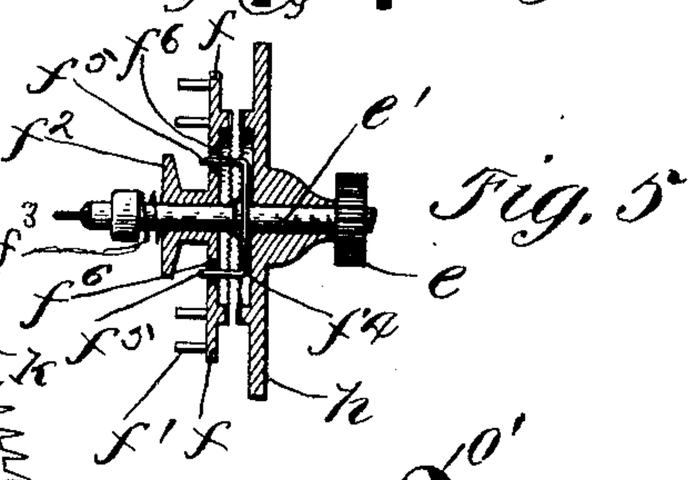

Fig. 5

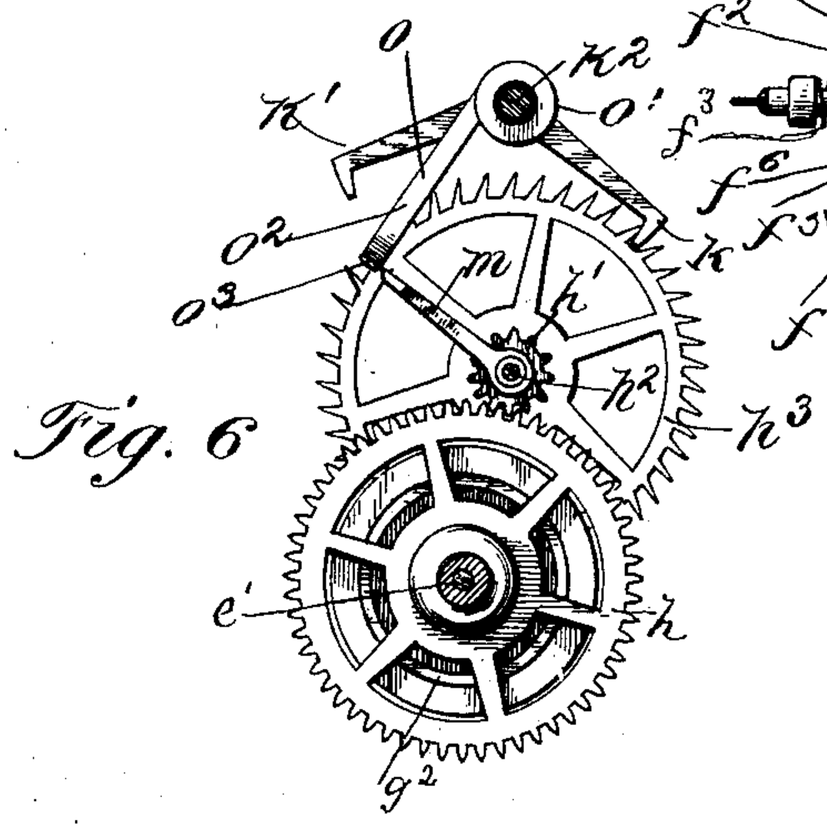

Fig. 6

Fig. 7.

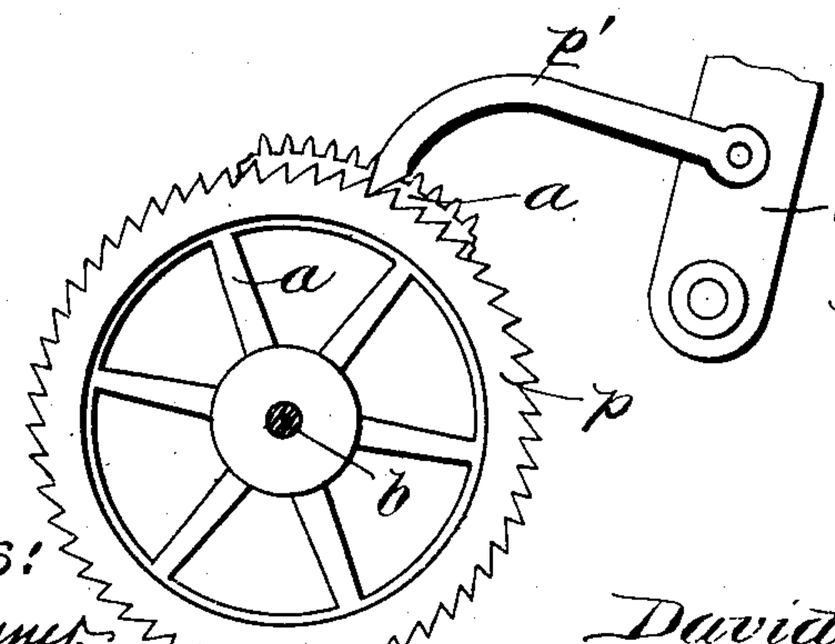

Fig. 8.

Witnesses:
De Witt C. Tanner.
W. Clyde Jones.

Inventor:
David W. Thompson,
By Barton & Brown,
Attorneys.

No. 754,622. PATENTED MAR. 15, 1904.

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NO MODEL. 3 SHEETS—SHEET 3.

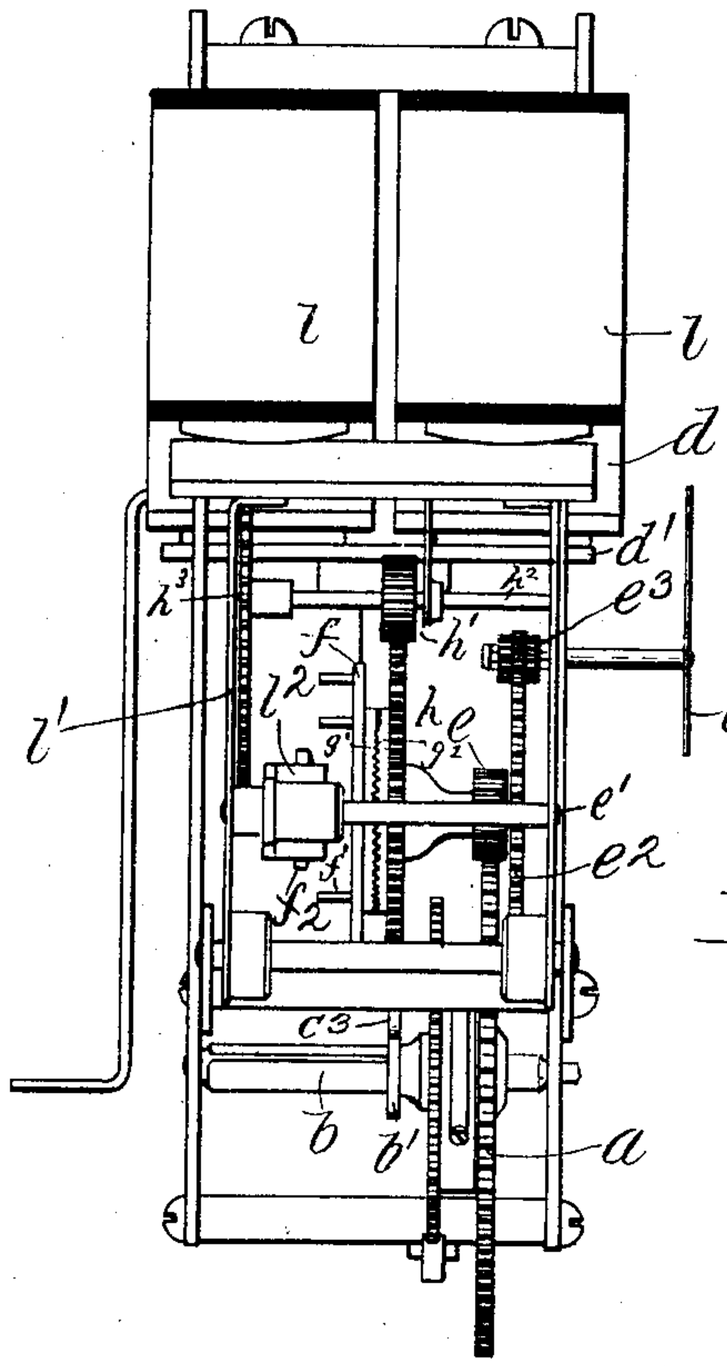

Fig. 9.

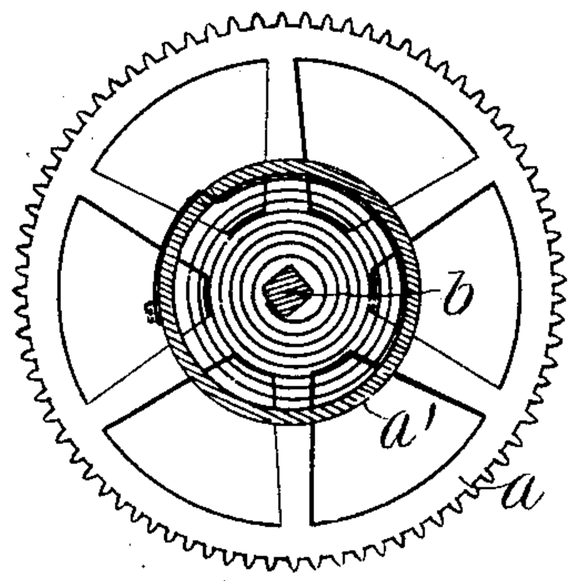

Fig. 10.

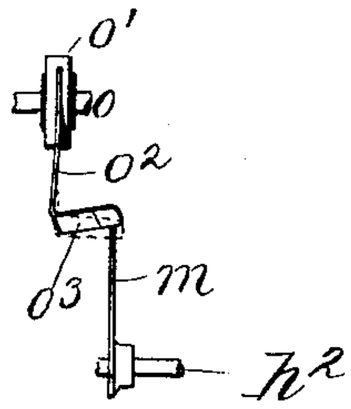

Fig. 11

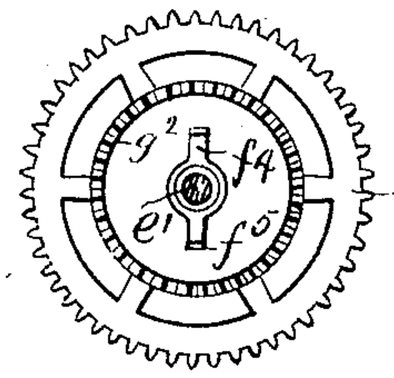

Fig. 12.

Witnesses:
D. W. C. Danner.
A. D. Lawrence

Inventor:
David W. Thompson
By Barton Brown
Attorneys.

No. 754,622. Patented March 15, 1904.

UNITED STATES PATENT OFFICE.

DAVID W. THOMPSON, OF CHICAGO, ILLINOIS.

ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 754,622, dated March 15, 1904.

Application filed December 5, 1895. Serial No. 571,159. (No model.)

To all whom it may concern:

Be it known that I, DAVID W. THOMPSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Electrically-Operated Clocks, (Case No. 2,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an electrically-operated clock, its objects being to provide, first, an improved contact-spring adapted to close the circuit through the winding device; second, means independent of the actuating-spring for securing the synchronization of the timepiece, and, third, an improved synchronizer for the seconds-hand.

It has been the usual practice in the construction of electric clocks to provide a mainspring one end of which is mounted on the barrel, while the other end is mounted to move with the main wheel of the train, a ratchet-wheel being provided adapted to rotate with the barrel and rotated through the agency of an electrically-operated device. With this construction when the battery is strong the spring is entirely wound up and subjected to maximum tension, and the surplus power of the battery is exerted upon the end of the spring, eventually breaking it, due to the excessive strain thus produced. This construction is objectionable because a strong battery—for instance, a battery when new—will completely wind up the spring, thus placing considerable tension thereon, liable to break the same, while as the battery weakens with use the spring is wound to a less and less degree until, finally, when the battery becomes very weak the spring is not wound sufficiently to operate the clock. Its time-measuring qualities will be impaired, and the clock will finally be liable to stop with the contacts of the circuit-controller in engagement, thus throwing the battery permanently into circuit and causing the running down and consequent destruction of the battery. With these objections in view I have provided a construction wherein one end of the mainspring is secured to the main wheel of the train, and the other end is secured to the loosely-mounted ratchet-wheel or winding-wheel, while ordinary stops are provided, one member mounted upon the shaft carrying the main wheel of the train, thus rotating with the inner end of the spring and the other member upon the ratchet-wheel rotating with the outer end of the spring, the stops being constructed to permit a predetermined movement of the winding-wheel relatively to the main wheel, thus limiting the action of the mainspring to preferably two and three quarters turns. These stops operate to thus limit the tension of the spring independent of the means employed for winding or contact. An electrically-operated radius-link is provided adapted to move the ratchet-wheel to wind up the spring. The winding-magnet energized periodically rotates the ratchet-wheel and maintains the spring wound up to the limit of the stopping device. By this construction the stops come into engagement as soon as the ratchet-wheel has been rotated to the predetermined distance relatively to the main wheel, and thus further movement of the ratchet-wheel is prevented. With the stops so arranged the mainspring is never completely wound up or allowed to completely run down, and thus an undue tension is never placed upon the spring, and at the lowest there is sufficient power to prevent stopping while in contact. As the spring works through a small range only, the tension does not vary to any considerable degree, and thus remaining practically constant the clock forms a perfect timepiece. By this arrangement the clock works equally well with a strong or weak battery and is not affected by the weakening of the battery. So long as the strength of the current is above a predetermined value—that is, sufficient to operate the winding-magnet—the ratchet-wheel will be rotated to maintain the spring wound up

A feature of my invention relates to a synchronizer for the seconds-hand and comprises a clutch of any suitable construction adapted to be operated by a magnet to separate the portion of the train operating the seconds-hand from the portion of the train operating the escapement-wheel. The driving portion of the train being released, the seconds-hand

is rotated to zero position, where it is checked by the engagement of one of a number of pins carried upon a disk coming in contact with a stop-wire carried upon the lever of the armature, the end of the stop-wire being thrust forward into the path of the pin when the magnet is operated.

A further feature of my invention is the provision of a torsional contact device for closing the circuit through the electromagnets. Upon one or the arbors of the train is provided a contact-arm adapted to engage upon each rotation a vibrating contact-spring mounted to move with the pallets. The contact-piece is in the form of a flat spring with about one-third of its length bent at right angles. The outer end of the bent portion of the spring engages the rotating contact-arm. The flat dimension of the spring lies in the plane of rotation, so that the spring moves edgewise, and thus when the contact-arm engages the upturned end of the spring the spring yields by a torsional or twisting movement. This form of contact I find to give very satisfactory results, as it maintains a quick, firm, and even pressure between the contacts and is not bent out of position by continued use.

A further feature of my invention is the provision of a radius-link carried upon the armature-lever of the synchronizing-electromagnet adapted to engage and rotate the main wheel of the train or one of the other wheels when more convenient, whereby the synchronizing operation may be performed even though the clock be not wound up.

I will describe my invention more in particular by reference to the accompanying drawings, in which—

Figure 1 is a view in elevation of a clock embodying my invention. Fig. 2 is a top view thereof. Fig. 3 is a detached view showing the stop mechanism between the train and the driving ratchet-wheel. Fig. 4 is a view of the clutch for releasing the portion of the train driving the seconds-hand. Fig. 5 is a sectional view of the clutch mechanism. Fig. 6 is a view illustrating the contact-making device. Fig. 7 is a detailed view of the torsional contact-spring. Fig. 8 is a view of the auxiliary radius-link for moving the train when the synchronizing-electromagnet is energized. Fig. 9 is a side elevation of my clock. Fig. 10 is a detail view of the mainspring upon the driving-wheel. Fig. 11 is a detail view of the torsional contact-spring. Fig. 12 is a view somewhat in detail of the releasing-clutch, showing arm f^4.

Like letters refer to like parts in the several figures.

The main wheel a of the train is mounted upon the shaft b. The driving ratchet-wheel c is loosely mounted upon the shaft b and is adapted to be rotated by a radius-link c', carried upon the armature-lever d' of the winding-electromagnet d. A pawl c^2 prevents the backward movement of the ratchet-wheel. Upon the shaft b is mounted the actuating member of an ordinary stopwork b', while upon the ratchet-wheel c is mounted the limiting member c^3, the limiting member c^3 being constructed in this instance so that the ratchet-wheel c^3 may make but two and three-quarters turns relatively to the wheel a. One end of the mainspring is secured to the spring-barrel a', connected to ratchet c, loosely mounted upon the shaft b, while the other end of the spring is secured to the shaft b. The winding-electromagnet d is energized once every two minutes, and the ratchet-wheel is thus periodically rotated sufficiently to maintain the mainspring continuously wound up, the stops b' and c^3 being thus maintained in engagement. By thus mounting the members of the stopwork upon relatively moving parts to which the ends of the mainspring are connected it is impossible to completely wind up the mainspring, and the placing of an undue tension on the spring is thus prevented. The mounting of both members of the stopwork in this manner upon moving parts of the train, whereby the ends of the mainspring partake of a differential movement, due to the periodical winding of the ratchet-wheel c and the continuous movement in the same direction of the driving-wheel a, is a novel and important feature of my invention.

The second feature of my invention relates to the synchronizing of the seconds-hand. Meshing with the main wheel a is a pinion e, mounted upon the arbor or shaft e'. A wheel e^2 is also mounted upon the shaft e' and engages with the pinion e^3, which drives the seconds-hand e^4. A disk f, carrying pins f' f' upon its face, is also mounted to rotate with the shaft e', whereon it is laterally movable, the said disk carrying upon its face one member g' of a toothed clutch device g, the other member, g^2, of the clutch being mounted upon the wheel h, which alone is loosely mounted upon the shaft e', the remaining members of the train continuously rotating with the said shaft. The verge-wheel h^3 and pinion h' are mounted upon the shaft h^2, the said pinion meshing with the wheel h. Pallets k k', which are mounted upon the oscillating shaft k^2, engage the teeth of the verge-wheel h^3. Upon the armature-lever of the synchronizing-magnet l is carried a flat forked arm l^2, the forked end of which is bent at an angle presenting inclined planes, which is adapted to engage opposite sides of the flange or collar f^2, formed integrally with the disk f. A coiled spring f^3 bears against the said flange f^2, serving normally to maintain the two members g' g^2 of the clutch in engagement. When the synchronizing-magnet is energized, the armature is attracted and the arm l^2 thrust forward, the bent end thereof serving to separate the members g' g^2 of the clutch device against the tension of the spring

f^3, as shown in Fig. 4, thus disengaging the entire clock-train from member g^2 of the clutch, wheel h, and the escapement, (the portion shown in Fig. 6,) the said wheel being loosely mounted upon shaft e'. The clock-train is now free to rotate until one of the pins f', carried upon the disk f, is engaged by the tongue or wire l^3, which is mounted upon the armature-lever and is moved thereby into the path of said pins, the wheel h, member g^3 of the clutch, and escapement alone remaining stationary. The tongue l^3 serves to check the clock-train when the seconds-hand has reached the zero position. When the magnet l is deënergized, the armature-lever l' is moved to withdraw the plate l^2 from engagement with the collar f^2 and the spring f^3 moves the members of the clutch into engagement. The wire l^3 is likewise withdrawn from engagement with the pin f', and the train is restored to normal condition. I preferably arrange eight pins f' upon the disk f, the disk being geared so that the disk makes one-eighth of a revolution while the seconds-hand is making a complete revolution.

The detailed construction of the clutch is illustrated in Figs. 4 and 5. Rigidly secured at its center to shaft e' is an arm f^4, internally mounted between the members of the clutch. At right angles to the said arm and parallel to the shaft are provided the fingers f^5 f^5 upon the arm, which extend through the holes f^6 f^6, provided in the disk f, the said disk being loosely mounted upon the shaft e'. The disk f is thus capable of a slight longitudinal play to engage and disengage the clutch-wheel caused to rotate with the shaft e'. The gear-wheel h is mounted loosely upon the shaft.

A further feature of my invention consists in a contact-making device which is illustrated in detail in Figs. 6, 7, and 11. A contact-arm m is mounted upon the shaft h^2, carrying the verge-wheel h^3, and is connected with one side of the circuit extending through the winding-electromagnet d. Upon the shaft k^2, carrying the pallets k k', is mounted a torsional contact-spring o, which comprises a hub o', to which one of the conductors is also attached. The spring has its end o^3 bent at right angles, adapted to be engaged by the contact-arm m. When the contact-arm m has been rotated into the position shown in Fig. 11, the extended end o^3 of the spring o by the rocking of the shaft is brought into engagement with the end of the contact-arm, thereby twisting the body portion of the spring and securing a brushing contact of momentary duration while the parts are in engagement in passing each other, the contact-arm rotating with the verge-wheel upon the shaft h^2, while the contact-spring oscillates with the shaft k^2 of the escapement. The resiliency of the contact-spring thus arises from the twisting of the part o^2, and a torsional contact-spring is thus provided which is adapted to furnish a firm momentary contact. As shown more clearly in Fig. 6, the contact-spring o^2 is mounted to oscillate with the pallets k k', the timing being such that as the oscillating contact-spring o strikes the upper end of the contact-arm the arm is moving beneath the spring. A sliding or brushing contact thus results which is of momentary duration, as the contact is immediately broken by the spring o^2, which being subjected to a torsion snaps the end o^3 past the arm m. The end of the contact-arm is cut away on an angle to prevent the contact-spring from clinging to the contact-arm. In constructions heretofore employed the contact-arm has been at rest when engaged by the upper contact; but according to my invention the parts are so timed that as the contact-arm is rotating the contact-spring is moved momentarily into engagement with the contact-arm, the said spring serving both to secure a firm contact and immediately break the same.

In Fig. 8 I have illustrated a further feature of my invention, wherein a ratchet-wheel p is provided upon the main wheel a, with which a radius-link p', mounted upon the armature-lever l', is adapted to engage, so that when the synchronizing-electromagnet l is energized to disengage the clutch g and release the portion of the train driving the seconds-hand the main wheel a will be rotated by the radius-link p' to move the seconds-hand to the zero position regardless of the spring, so that should the clock be nearly run down the synchronizing of the clock may be effected.

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

1. In an electrical contact device, the combination with a contact-arm m mounted upon a rotating part h^2 and forming one circuit-terminal, of a second circuit-terminal part mounted upon an oscillating shaft o', the said terminal part consisting of a thin spring-like body portion o^2 and an angularly-extended end o^3, the said circuit-terminals being so mounted as to engage the edge of the extension o^3 with the end of arm m while the said parts are respectively in motion, whereby part o^2 is placed under torsion and the circuit is momentarily closed, substantially as described.

2. In an electrically-operated clock, the combination with the driving-wheel thereof, of means controlled by the synchronizing device for advancing the said driving-wheel to secure the synchronization of the seconds-hand in event the mainspring of the clock fails to operate, substantially as and for the purpose specified.

3. In an electrically-operated clock, the combination with the ratchet-wheel p rotating with the driving-wheel of the radius-link p' engaging the teeth of the said ratchet-wheel, the synchronizing-electromagnet l, and pivot-

ed armature l' with which the said radius-link is connected to advance the clock-train and secure the synchronization of the seconds-hand in event the mainspring of the clock fails to operate when the synchronizing-magnet is energized, substantially as and for the purpose specified.

4. In a synchronizer for the seconds-hand of a timepiece, the combination with the driving-train of said timepiece, of the arbor e' mounted in said train and carrying intermediate parts thereof, the disk f rotating therewith and laterally movable thereon carrying one member of the clutch g, the pins f' f' secured to said disk, the electromagnet l, the pivoted armature l', the arm l^2 secured thereto and adapted to laterally move the said disk and separate the members of the clutch, the loosely-mounted wheel h meshing with the pinion upon the escapement-arbor and carrying the other member of the clutch g and the tongue l^3 mounted upon the pivoted armature and adapted to be extended thereby within the path of the pins f', substantially as and for the purpose specified.

5. The combination with the shaft b carrying the main wheel a, of the clock-train, the ratchet-wheel c mounted loosely upon said shaft, the mainspring, one end thereof being mounted to rotate with said ratchet-wheel and the other end to rotate with said clock-train, an electromagnet d, pivotally-mounted armature d', link c' connecting the said armature and the ratchet-wheel and adapted to rotate the latter step by step in one direction, a torsional contact-spring o mounted upon the rocking shaft k^2, contact-arm m rotating with shaft k^2 adapted to engage the said torsional contact-spring and momentarily close the circuit through the actuating-magnets, and stops b' c^3, independent of the circuit-closing device, mounted upon said shaft and ratchet-wheel respectively and adapted to permit the ratchet-wheel to effect several complete revolutions relatively to the trains, substantially as described.

6. In a synchronizer for the seconds-hand of a timepiece, the combination with the arbor of an intermediate wheel, of one member of a clutch device mounted loosely and laterally movable thereon, rotating with the said arbor, a second member of the clutch device secured to a wheel loosely mounted upon the intermediate arbor and meshing with a pinion upon the escapement-arbor, an electromagnet and pivoted armature, an arm attached to said armature, adapted to engage the laterally-movable element of the clutch device and force it from engagement with the second member thereof, detents provided upon the aforesaid disk and an engaging arm therefor carried upon the pivoted armature adapted to stop the seconds-hand in its zero position when the driving-wheel has been released by the action of the said armature, substantially as described.

7. In an electrically-operated clock, the combination with a main driving-spring, of a driving-wheel driven thereby, a contact-arm continuously rotating with the clock-train, a torsional contact-spring oscillated with the pallets of the escapement adapted to engage the said contact-arm while in motion, thereby securing a brushing electrical contact therewith of short duration, electromagnetic means for winding the mainspring of the clock controlled by a circuit through the said contacts, an electromagnetically-controlled synchronizing device for disengaging the escapement from the clock-train to permit the rotation of the seconds-hand to a zero position, and means controlled by said electromagnetic synchronizing device to cause the advancement of the driving-wheel independent of the condition of the main clock-spring, substantially as described.

In witness whereof I hereunto subscribe my name this 18th day of November, A. D. 1895.

DAVID W. THOMPSON.

Witnesses:

W. CLYDE JONES,

JOHN W. SINCLAIR.