(No Model.) 2 Sheets—Sheet 1.

C. L. CLARKE.

ELECTRIC CLOCK SYSTEM.

No. 347,572. Patented Aug. 17, 1886.

Fig. 1,

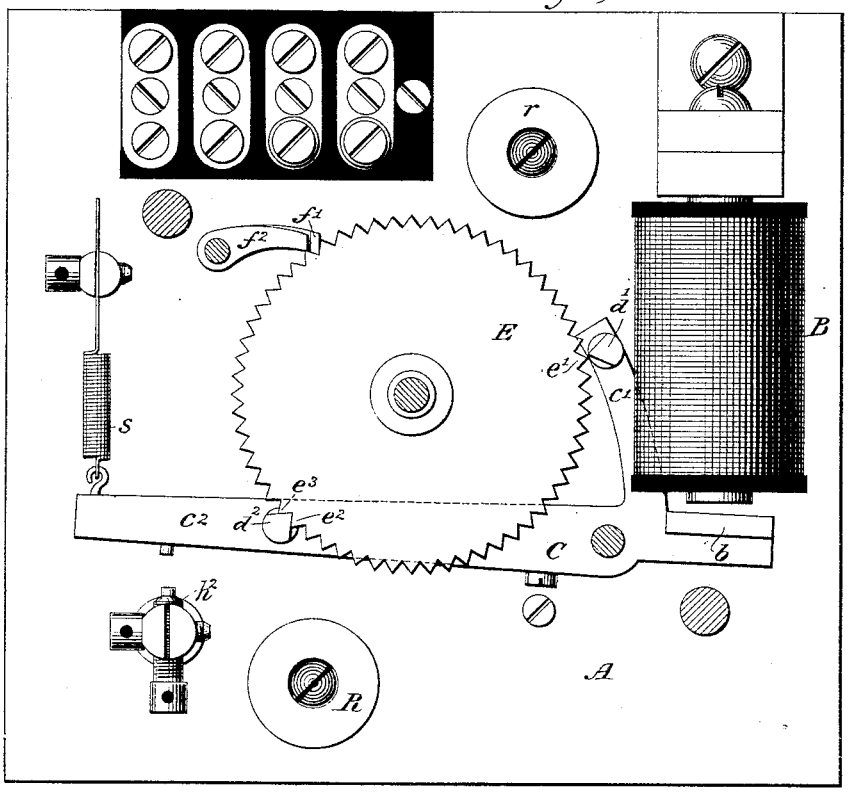
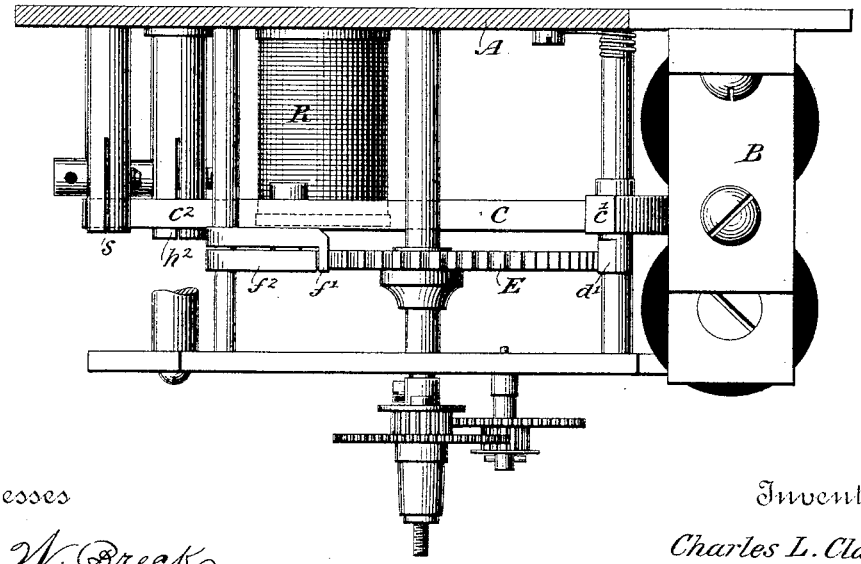


Fig. 2,



Witnesses
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Carrie E. Ashley

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(No Model.) 2 Sheets—Sheet 2.

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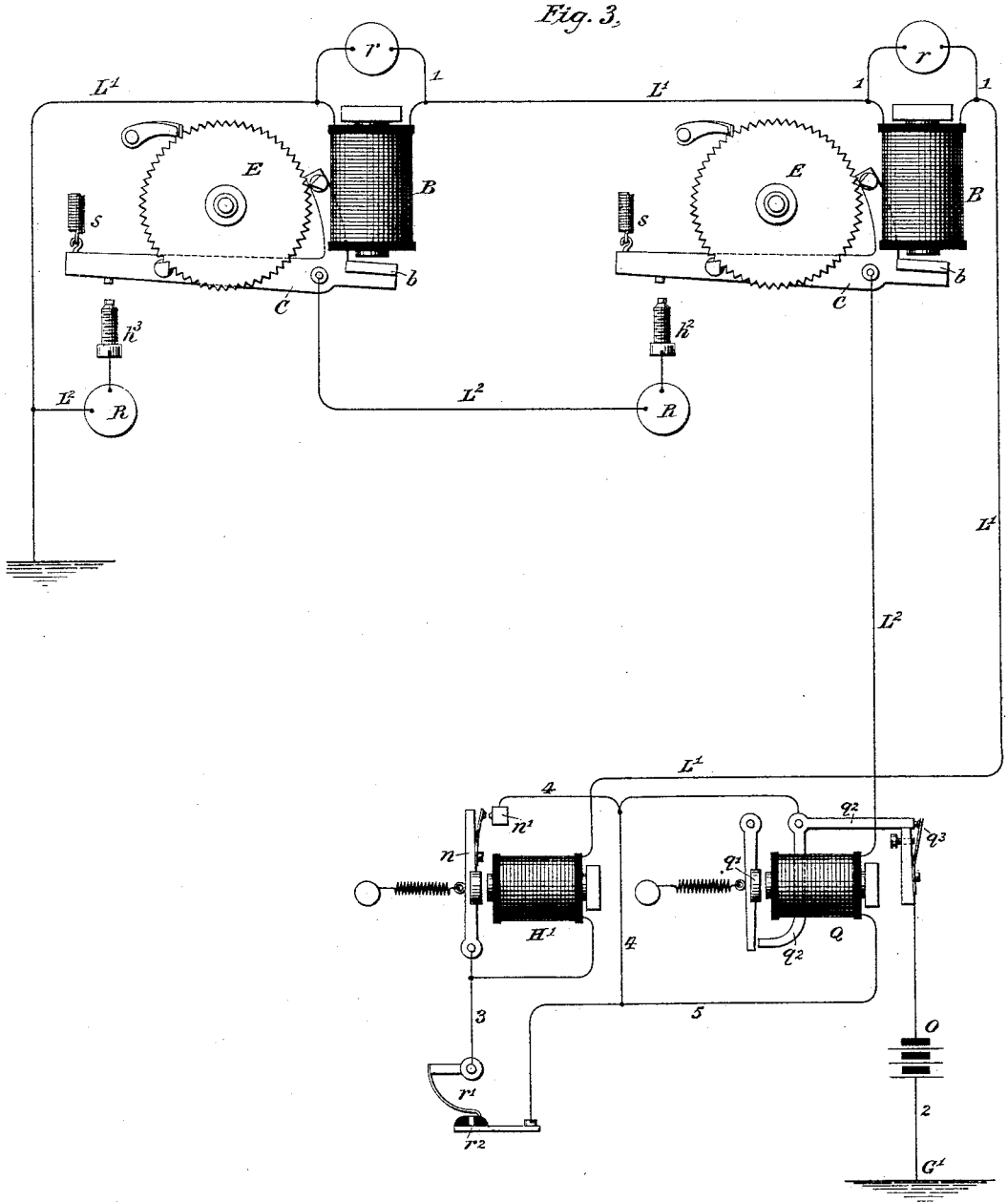
Fig. 3.



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UNITED STATES PATENT OFFICE.

CHARLES L. CLARKE, OF EAST ORANGE, NEW JERSEY.

ELECTRIC-CLOCK SYSTEM.

SPECIFICATION forming part of Letters Patent No. 347,572, dated August 17, 1886.

Application filed May 21, 1886. Serial No. 202,834. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. CLARKE, a citizen of the United States, residing in East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electric-Clock Systems, of which the following is a specification.

My invention relates to the construction of the class of devices controlled by electric currents transmitted from more or less distant points for the purpose of indicating time.

The object of the invention is to provide convenient, simple, and efficient means for causing the successive impulses to advance the clock-movements the required distance to insure that there shall be no excess of movement, and that the movement shall be as perfectly locked as possible at all times, and to maintain the circuits and circuit-connections in proper condition.

In carrying out the invention, the clock-movements are constructed in essentially the following manner: An electro-magnet designed to be included in the main-line circuit is provided with an armature carried upon a lever having two pawls respectively designed to engage at different times the teeth of the main driving-wheel of the movement. A double locking-pawl is applied to the wheel, and this is constructed in such manner that when one pawl is in engagement with the wheel the other is at the apex of one of the teeth, and vice versa. These two pawls are supported from the same pivot, and as one is being lifted from engagement with the wheel the other is entering the space between the two succeeding teeth. One pawl extends at right angles across the end of the other, for the purpose of bringing it into position to engage the wheel. When a large number of clocks are included in series in a single circuit, it is desirable that some means should be employed for insuring that all have been actuated before the connections of the driving-circuit are interrupted. For this purpose an organization of circuits somewhat similar to that described in my Patents Nos. 327,526 and 327,527 is employed. Two main lines are employed, one being designed to convey the currents for actuating the movements, and the other for operating a circuit-interrupting device. When its connections are completed by the operation of all the movements, both circuits are supplied from the same battery, and, as it is desirable that the resistance of the two should be approximately equal whatever number of clocks are included in circuit, and, as the number is liable to be variable, each secondary movement is supplied with an artificial resistance which is approximately equal to that of the actuating-magnet. Whatever resistance is then added to one line by an additional actuating-magnet will be compensated in the other line by an artificial resistance.

In the accompanying drawings, Figure 1 is a front elevation. Fig. 2 is a plan, partly in section; and Fig. 3, a diagram illustrating the organization of a system.

Referring to the figures, A represents a supporting-plate upon which several parts of the instrument are carried. An electro-magnet, B, acting upon an armature, *b*, is employed for operating a lever, C. The lever C is constructed with two arms, c' and c^2, which respectively carry pawls d' and d^2. The pawls are designed to engage the main wheel E of the clock-movement, and a spring, *s*, normally holds the lever in the position shown in the drawings, with the pawl d^2 engaging the teeth of the wheel, the pawl d' being out of the path of the teeth and the armature *b* away from its electro-magnet. When the magnet is vitalized, the armature is drawn forward, the pawl d' strikes one of the teeth e' near its apex, and by entering farther advances the wheel. Meanwhile the pawl d^2 is being withdrawn between two teeth, e^2 e^3, thus permitting the forward movement of the wheel. When the pawl d' has completed its forward movement, the tooth e^3 will have advanced a sufficient distance to be engaged upon the opposite face by the pawl d^2 when the lever returns to its normal position, thus completing the advancement of the wheel E a distance corresponding to one tooth.

For the purpose of preventing any retrograde movement of the wheel during the time the pawls are out of engagement, two retaining pawls or dogs, f' and f^2, are employed. The former, which extends around the end of the

latter of these, is in engagement with the wheel, falling to the base of two of the teeth when the wheel is at rest, while the latter is at that moment upon the apex or crown of the succeeding tooth. The advancement caused by the pawl d' will allow the pawl f^2 to pass between two succeeding teeth. At the same time the pawl d' will be gradually raised from the position shown in the drawings. The faces of the pawls are formed at such angles that they permit a forward movement of the wheel E, although preventing a backward movement of the same.

As it is desirable that the electro-magnet B should be shunted for the purpose of preventing it from sending to the main line a strong discharge-current when it becomes demagnetized, a permanent shunt-circuit of high resistance is closed around its coils by means of a conductor, 1, including an artificial resistance, r.

The currents required for operating the several clocks which are included in a main line, L′, (see Fig. 3,) are derived from a battery, O, which is in this instance located near the transmitting apparatus. One pole of this battery is connected with the earth at G′ by a conductor, 2, while the other pole is connected through a circuit-interrupting device and by a conductor, 5, with a contact-point, r^2, constituting a portion of any suitable form of circuit-closing device. An arm, r', applied to any moving part—say the second-hand arbor of the master-clock—is carried forward by the movements of the second-hand arbor and makes sliding contact once each minute or at any other predetermined interval with the contact-point r^2. The point r^2 is so placed that a single beat of the pendulum or a single continuous movement of the second-hand arbor will carry the arm into and out of contact with the point. The arm r' is connected by a conductor, 3, through the coils of an electro-magnet, H′, with the main line L′, including the actuating-magnets of the several clocks. It is designed that for the momentary connection formed by the sweep of the arm r' a continuous connection shall be substituted for the main line L′, which will continue until the circuit is interrupted at some other point. For this purpose the armature n of the electro-magnet H′ is connected with the arm r', and a front contact-point, n', applied thereto, is connected by conductor 4 with the conductor 5, leading to the point r^2. The vitalization of the electro-magnet H′ thus causes a circuit to be completed independently of the arm r' and point r^2.

The circuit-interrupting device consists of an electro-magnet, Q, included in a second main line, L^2, branching from the conductor 5. This electro-magnet is provided with an armature, q', which when drawn forward strikes against one arm of a lever, q^2, the opposite arm of which normally rests against the contact-point q^3. The point q^3 is connected with a battery, O, and the conductor 5 leads from the lever q^2. When the armature q' is actuated, the lever q^2 is thrown out of contact with the point q^3, thereby interrupting the connections of the battery through both lines. The connections of the line L^2, however, are not completed until all the clocks have been actuated, for the reason that the line leads to the armature-lever of the first clock of the series, while the contact-point h^2, applied to the lever, is connected with the lever of the succeeding clock, and so on throughout the series. In this manner the circuit is completed only when all the levers rest against their respective contact-points h^2.

It will be evident that each clock which is added to the system will introduce a resistance in the main line L′, and unless some means are provided for equalizing the resistance of the line L^2 the resistance of the line L′ would ultimately so far exceed that of the line L^2 as to cause the current to be immediately diverted from the line L′ the moment the connections of the line L^2 are completed, thus causing the electro-magnet H′ to be demagnetized too quickly. To avoid this, a resistance, R, is included between each lever, C, and the conductor leading thereto from the corresponding section of the main line L^2, which is approximately equal to the resistance of the corresponding actuating-magnet B.

I claim as my invention—

1. The combination, with an electro-magnet and a clock-movement, of a lever actuated by the magnet, two pawls carried by said lever and engaging the teeth of one of the wheels of said movement, two independent retaining-pawls resting upon the teeth of said wheel and respectively engaging the teeth at different points in its movement, substantially as described, and a circuit-closing device consisting of said lever and the limiting-stop applied thereto.

2. In an electric clock-movement, the combination of an actuating-magnet, a lever controlled thereby and having two arms extending upon the opposite sides of a wheel of said movement, two driving-pawls respectively carried upon said arms, two retaining-pawls respectively engaging the teeth of said wheel at different points in its revolution, said pawls being supported in the same axial line and one of them extending across the end of the other.

3. The combination of a series of electro-magnets, devices actuated thereby, a main line including the same, means for completing a circuit through said main line, a second main line having its connections completed by the operation of all of said devices, an artificial resistance included in said second main line at each of said devices, and a circuit-interrupting device actuated by a current through said second main line.

4. The combination of a battery, two main lines deriving currents therefrom, a series of

electrically-actuated devices having their actuating-magnets included in one of said main lines, a circuit-interrupting device for said main line having its actuating-magnet included in the second of said main lines, means for completing the circuit of the second line when all of said devices have been actuated, and an artificial resistance included in the circuit of the second line at each of said devices, substantially as described.

In testimony whereof I have hereunto subscribed my name this 12th day of May, A. D. 1886.

CHAS. L. CLARKE.

Witnesses:
CAROLINE E. DAVIDSON,
CHARLES A. TERRY.