No. 628,325. Patented July 4, 1899.

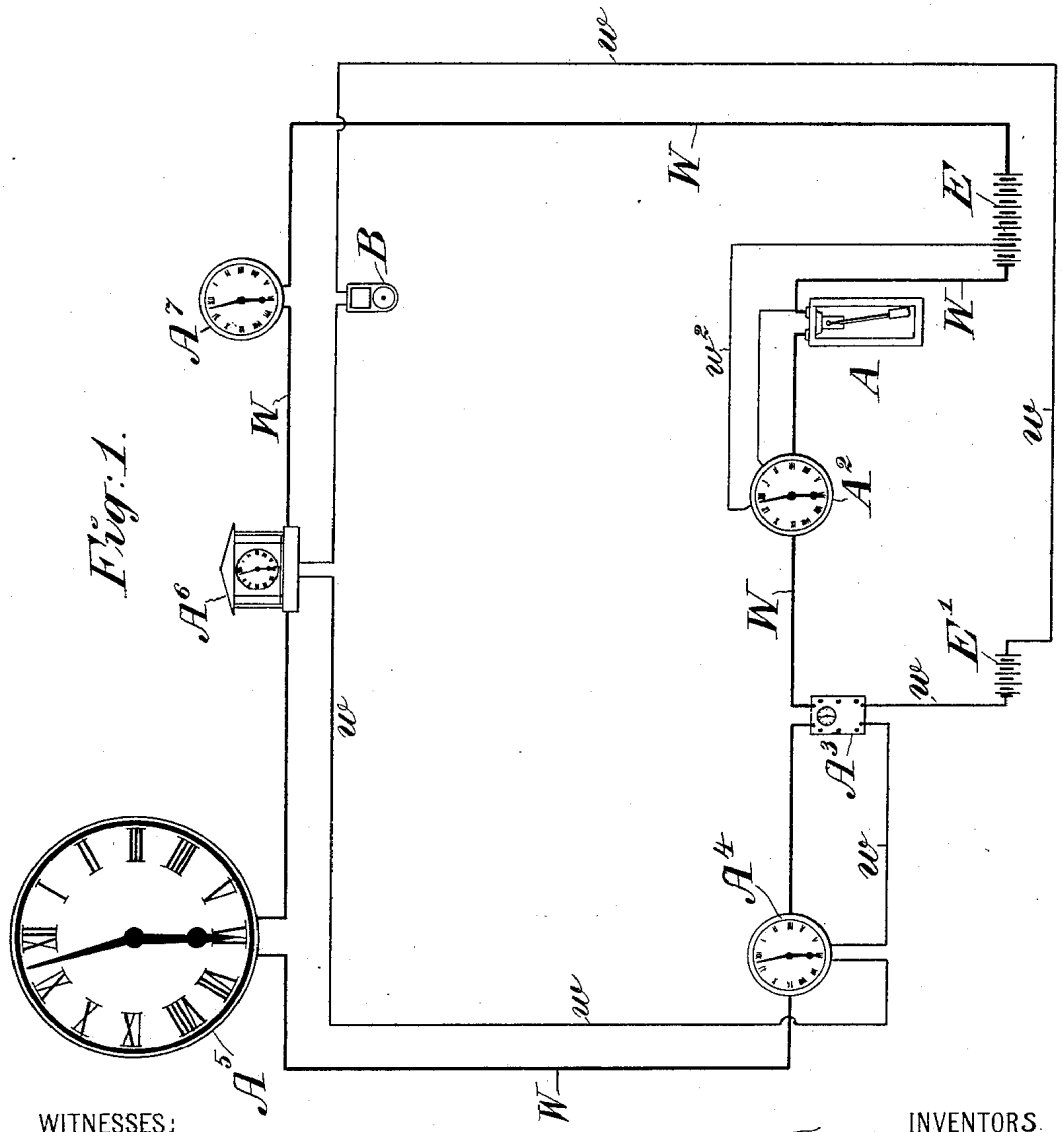
F. HOPE-JONES & G. B. BOWELL.

ELECTRIC CLOCK SYSTEM.

(Application filed Dec. 29, 1897.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



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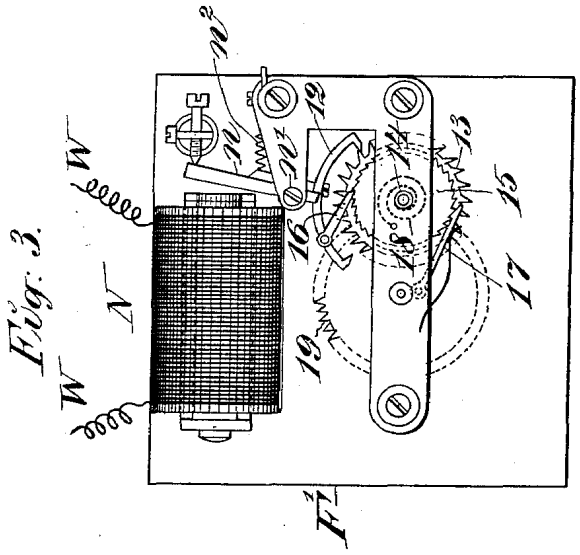

Fig. 3.

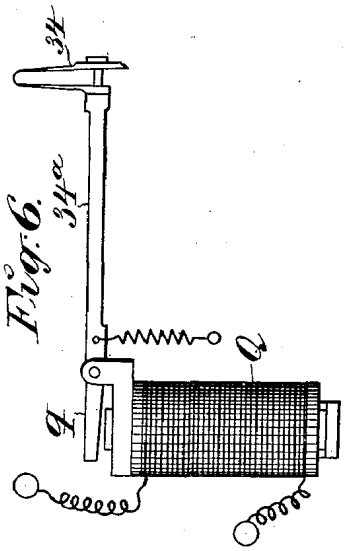

Fig. 6.

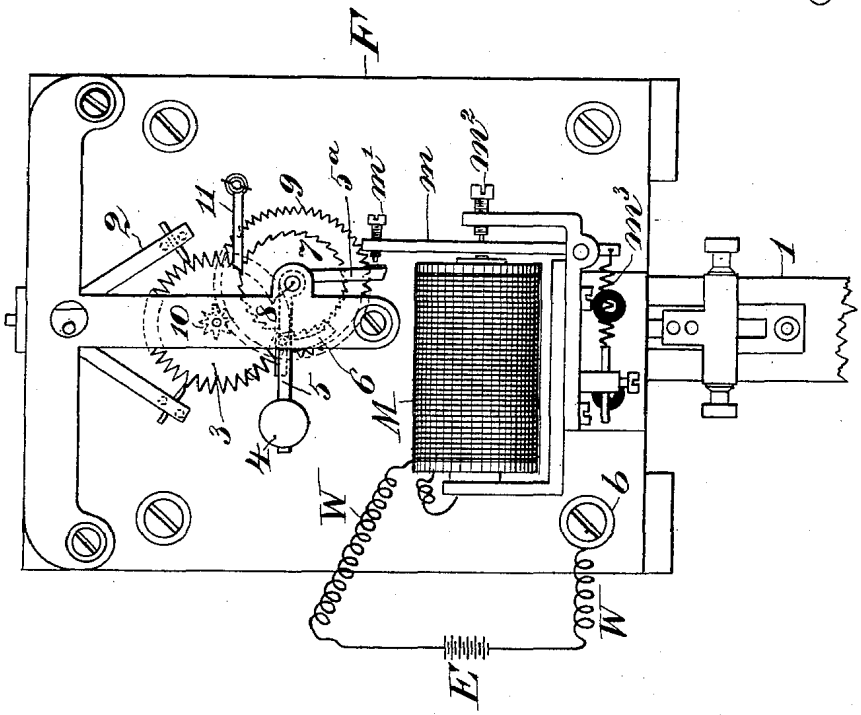

Fig. 2.

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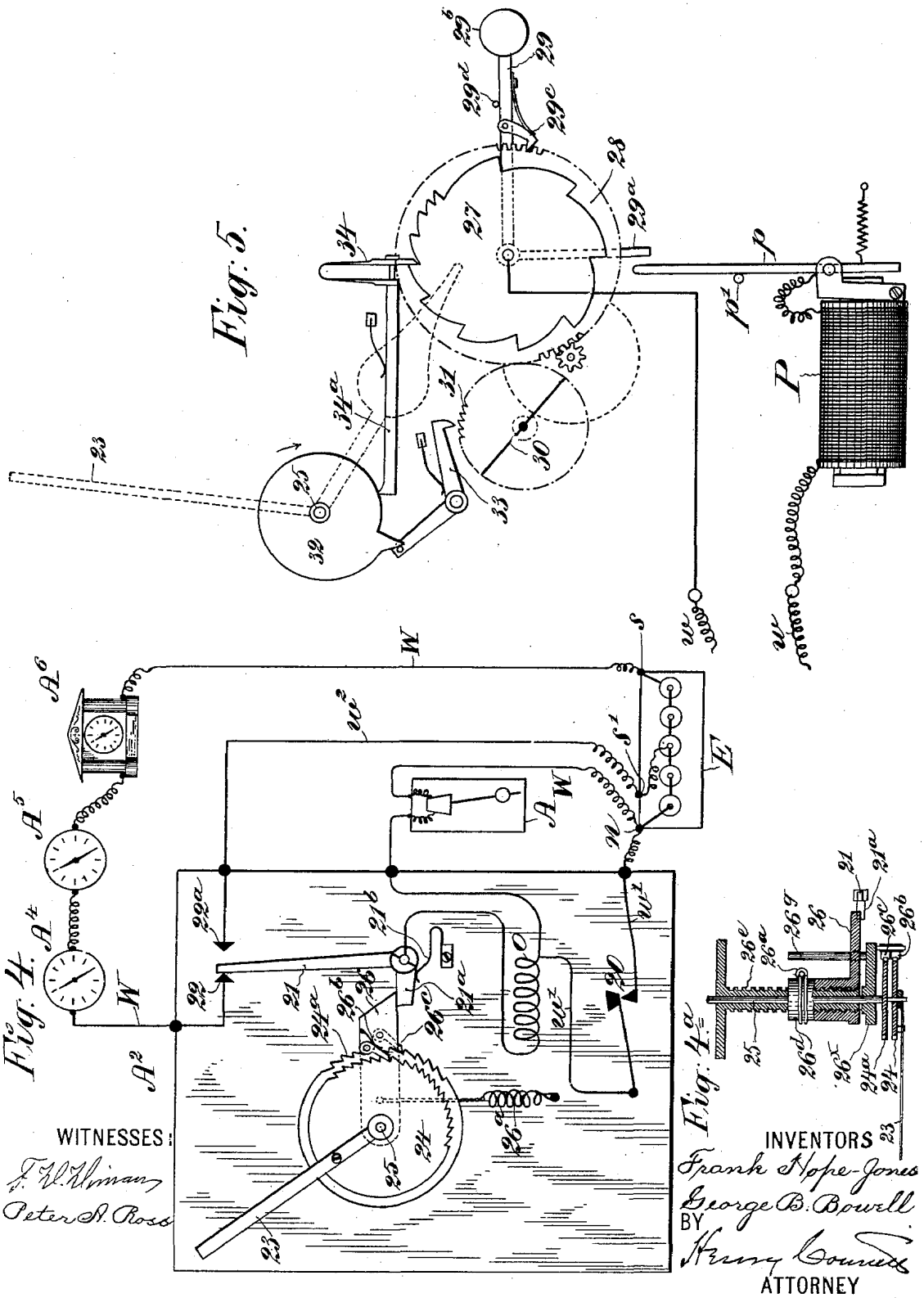

UNITED STATES PATENT OFFICE.

FRANK HOPE-JONES AND GEORGE BENNETT BOWELL, OF LONDON, ENGLAND.

ELECTRIC-CLOCK SYSTEM.

SPECIFICATION forming part of Letters Patent No. 628,325, dated July 4, 1899.

Application filed December 29, 1897. Serial No. 664,382. (No model.)

To all whom it may concern:

Be it known that we, FRANK HOPE-JONES and GEORGE BENNETT BOWELL, subjects of the Queen of Great Britain, residing at London, England, have invented certain new and useful Improvements in Electrical Clocks, (for which patents have been granted in England, No. 1,587, dated January 23, 1895; in France, No. 255,760, dated April 22, 1896; in Belgium, No. 121,015, dated April 22, 1896, and in Germany, No. 97,364, dated April 23, 1896,) of which the following is a specification.

This invention relates to clocks operated and controlled by electricity; and it has for its object to construct the devices employed in a more simple and inexpensive manner than hitherto and at the same time to obviate certain difficulties which have heretofore arisen in the operation of this class of clocks.

In the accompanying drawings, wherein an embodiment of the invention is illustrated, Figure 1 is a diagrammatic view illustrating the complete installation, comprising a controller or primary clock and various secondary clocks, all constructed in accordance with this invention. Fig. 2 is a front elevation of the mechanism of the controller or primary clock, showing the preferred construction. Fig. 3 is a front elevation of a secondary clock or dial-movement. Fig. 4 is a somewhat diagrammatic view showing a special form of secondary clock joined in circuit with other secondary clocks and a primary clock and permitting the setting of the hands. Fig. 4^a is a sectional view illustrating a slight modification of the mechanism seen in Fig. 4. Figs. 5 and 6 are views illustrating mechanism for striking the hours.

Referring first to Fig. 1, A is the controller or primary clock, which need have no dial.

A^2, A^3, A^4, A^5, A^6, and A^7 are secondary clocks or dial-movements in circuit with and operated and controlled by the primary clock A. The secondary clock A^2 is so constructed that the setting back of its hands stops and sets right the remaining clocks, as will be hereinafter explained.

A^3 is a special secondary clock controlling a bell or striking circuit *w*, in which are a number of electric annunciators, as gongs or bells, at the several secondary clocks, either in the same casings with the clocks or adjacent thereto, as seen at B near the clock A^7.

W is the main operating or "going" circuit, and E is the battery or generator supplying the same.

E′ is a battery supplying the striking-circuit *w*.

The preferred construction of the primary clock A is illustrated in Fig. 2. In this view 1 is the pendulum, which is connected in the usual way with an escapement-anchor 2, the pallets of which engage the teeth of the escapement-wheel 3. This wheel is driven by a weight 4 on a pawl-arm 5, which carries a pawl 6, engaging as the weight descends the teeth of a ratchet-wheel 7 on an arbor 8. On this arbor is a spur-wheel 9, which gears with a pinion on the arbor of the escapement-wheel 3. This pinion is seen at 10 in dotted lines. The weight 4 is lifted in "winding" the clock by a magnet M, as will now be described.

The pawl-arm 5 has a contact-arm 5^a, which when the weight 4 reaches its lowest point makes contact with an adjustable screw-contact *m′* in the armature *m* of the magnet M, and thus closes the electric circuit through the said magnet. Instantly the magnet attracts the armature and the latter acts forcibly on the pawl-arm and weight to throw them up. The movement of the armature is slight, as it strikes the core of the magnet or some suitable stop, but the momentum of the weight and arm carries them up to the highest point. As soon as the contact is broken between the contact-arm 5^a and the armature the latter is again drawn back to its back contact m^2 by its spring m^3. The weight 4 now begins to descend, and when it reaches its lowest point the circuit is again closed and the winding operation repeated. A back pawl 11 engages the teeth of the ratchet-wheel 7 and prevents back rotation of the latter. As an appreciable time is required for winding, the wheel 9 may be mounted loosely on its arbor and be connected thereto by a volute spring, which will be normally under tension, and this spring will then keep the clock in motion during the brief period of winding; but the invention is not limited to the use of this spring and it is not really essential.

The electric circuit is illustrated diagram-

matically in Fig. 2. From one pole of the battery or generator E the current flows to and through the coils of the magnet M, thence to the frame of the magnet and through it to the back contact m^2, thence through the armature m to the contact m', thence to the pawl-arm, thence through the clock-frame F to a binding-post b, and thence back to the other pole of the battery. The period during which the circuit is closed is very short. The current which is permitted by the primary clock above described to flow through the circuit to the secondary clocks operates these latter in a manner well understood. I prefer, however, to use a particular construction of movement for the secondary clocks, which construction has the advantage that the hands of the clock are locked not only in their positions of rest but at all times during their movement. The preferred construction of the secondary clock is illustrated in Fig. 3 and is very simple.

N is a magnet in the circuit W, and n is its armature-lever, fulcrumed at n'. On the shorter arm of the armature-lever is an escapement-anchor 12, the pallets of which are adapted to engage the teeth of an escapement-wheel 13 alternately when the armature vibrates. On the same arbor 14 with the scape-wheel is mounted a ratchet-wheel 15, and carried by the anchor 12 is a pawl 16, engaging the teeth of the ratchet-wheel. On the frame F' of the clock is a back-stop pawl 17, which engages the teeth of the wheel 15 and prevents back rotation of the latter.

The ratchet-wheel 15 is loose on its arbor 14 and connected therewith by a volute spring 18.

When the electromagnet N is energized, the armature-lever n will be rocked on its fulcrum at n', causing the pawl 16 to advance and rotate the ratchet-wheel 15 and also causing one of the pallets of the anchor 12 to disengage and the other to engage the teeth of the scape-wheel. When the circuit is broken, the armature-lever will be rocked in the other direction by its spring n^2, the pawl 16 will withdraw, and the pallets of the anchor 12 will again shift, allowing the scape-wheel 13 to advance one tooth.

The center wheel 19 is driven in the usual manner from the arbor of the scape-wheel by a pinion thereon. (Not shown.)

In order to synchronize or regulate the position of the hands of all the secondary clocks in the circuit should they from any cause become "fast" or "slow," a special form of secondary clock, which is called a "governing-dial," is employed. This device is indicated by A^2 in Fig. 1 and its construction is diagrammatically illustrated in Fig. 4. In this figure the primary and secondary clocks and the circuit are shown.

The governing-dial A^2 is provided with a shunt w' to the primary clock and has a switch 20, so that the hands of all the secondary clocks, including, of course, the clock A^2, may be caused to move forward by closing the circuit a number of times independently of the movement of the primary clock A. If, however, the secondary clocks are fast, it is necessary to stop said clocks until the hands indicate the correct time and then permit them to move on again. This is done by moving back the hands of the governing-dial A^2 until they indicate the correct time, such backward movement being adapted to break the circuit through the remaining secondary clocks beyond, and to prevent the same from being closed again until the hands of the governing-dial (which have been set right) have reached the hour at which the secondary clocks were stopped.

Referring now to Fig. 4 for a more minute description, 21 is an angular switch-lever which, with the two contacts 22 22^a, at a point in the circuit constitutes a two-way switch. Normally, as in Fig. 4, the lever 21 is in such a position that the current flows from the pole n of the battery E to and through the primary clock A, thence to and through the magnet O of the clock A^2, thence to and through the lever 21 to the contact 22, thence to and through the series of secondary clocks, and thence to the other pole s of the battery. If the switch-lever 21 be shifted, the current will flow, as before, to the lever 21, thence to the contact 22^a, and thence to the battery at s' by a conductor w^2.

The magnet O, which is represented diagrammatically in Fig. 4, operates the minute-hand 23 of the clock A^2 by the same means as have been described with reference to Fig. 3, this hand 23 being of course mounted frictionally on its arbor. A ratchet-wheel 24 is secured to the hand 23, and a similar wheel 24^a is rigidly fixed to the dial-movement.

Pivotally mounted to swing radially on the center-wheel arbor 25 is a pawl-arm 26, provided with a spring 26^a and pawls 26^b and 26^c, which engage the teeth of the respective ratchet-wheels 24 and 24^a. The spring 26^a holds the free end of the arm 26 pressed down upon the shorter arm 21^a of the lever 21, thus holding the latter against the contact 22 and opposing the light spring 21^b under the arm 21^a.

The operation is as follows: When the minute-hand 23 is turned backward, (by hand,) the pawl-arm 26 is raised by the ratchet-wheel 24 acting on the pawl 26^b, thus allowing the spring 21^b to shift the switch-arm 21 to contact 22^a. This has the effect to cut the secondary clocks A^4, A^5, and A^6 and their battery out of the circuit. The pawl 26^c in the meantime rides or wipes over the teeth of the ratchet-wheel 24^a and acts as a back-stop to prevent the sudden return of the hand 23. The forward progress of this hand, though assisted by the spring 26^a and the pawl-arm and pawl, is controlled by a magnet and mechanism like that previously described. When the hand 23 shall have again reached the position it occupied before it was moved backward, the arm 26 will again press on the short arm of the switch-lever 21 and shift said arm

to the contact 22, thus again switching the secondary clocks into the going-circuit. If it be desired to provide sufficient latitude to enable the hands to be turned back several hours, the construction illustrated in Fig. 4ª may be employed. In this construction the arm 26 is mounted on a screw, so that the number of hours may be recorded by the lateral position of the arm along the screw. This arrangement insures that the arm shall move laterally, so as to clear the arm 21ª of the contact-lever 21 at the completion of the first revolution, the movement being backward or inward. As seen in the sectional view, Fig. 4ª, the arm 26 has a screw-threaded sleeve or boss 26ᵈ, screwed onto a fixed tubular screw 26ᵉ, through which passes the arbor 25. On this arbor is a supplementary arm 26×, which carries the pawls 26ᵇ and 26ᶜ and which has a laterally-projecting runner 26ᵍ, which passes through a hole in the arm 26. This runner compels the arms 26 and 26× to move together about the arbor, but permits the arm 26 to move laterally along the screw. The ratchet-wheels and minute-hand are arranged as in Fig. 4. The spring 26ª may be attached to the sleeve or boss 26ᵈ by a chain, so as to wind thereon. This is clearly shown in Fig. 4ª. The operation of this device in setting back the hands several hours is as follows: When the hand 23 is rotated back more than one complete rotation, it moves the arm 26 out of register with the short arm of the lever 21, as the runner 26ᵍ carries the arm 26 with it. When the hands have been moved back as far as desired, the pawl 26ᶜ prevents return by its engagement with the ratchet-wheel 24ª, which latter is rotated forward step by step by means of the electromagnetic mechanism before described. It will be seen that if the clock-hands have been turned back, say, three and one-half hours the arm 26 will not be brought back by the forward movement of the clock, so as to act on the switch-lever 21, until the clock-hands indicate the same time that they indicated at the moment they were turned back, and accordingly the switch will remain until that time in a position to switch out the several secondary clocks.

The device indicated at A³ in Fig. 1 for controlling the bell or striking circuit *w* is illustrated in detail in Fig. 5. The "going" portion of this device is driven from the main operating or going circuit, controlled by the primary clock A, and this going portion also locks and lets off at the proper time a striking plate or wheel 27, which is rotated by an electromagnetic device through the medium of a spur-wheel 28, to which it is rigidly connected. The operating device comprises an electromagnet P, its armature-lever *p*, an elbow-lever 29 29ª, which swings radially about the wheel 28 and carries a weight 29ᵇ, and a pawl or dog 29ᶜ, which engages the teeth of the wheel 28. This weight device is in substance the same as that seen in Fig. 2, the circuit being closed when the upper end of the armature-lever *p* encounters the pendent arm 29ª of the weighted elbow-lever. The sudden movement of the armature then throws up the weighted lever, causing the pawl thereon to engage the next tooth above on the wheel. The upward movement of the lever is limited by a stop 29ᵈ, and the armature-lever is limited in its movement by a back-stop *p'*. The fan 30 and a ratchet-wheel 31 on the arbor of the fan are driven from the wheel 28 by a train of gears. (Indicated mainly by dotted lines.)

On the same arbor with the minute-hand is secured a cam 32, which at each hour sets free the ratchet-wheel and fan (and with them the striking mechanism) by raising a detaining-pawl 33, which engages the teeth of the ratchet-wheel 31. This cam also acts through a detent-lever 34ª to raise a spring-detent 34, which engages the teeth of the striking-plate 27 and serves to regulate the number of strokes.

As herein shown, the clock strikes the hours only, and consequently there are seventy-eight teeth in the wheel 28. The detent 34 is made in the form of a U-shaped spring, so that when raised free from the shoulder formed by the tooth of the striking-plate, where it is under some tension, by the cam 32 and falls back it will not reëngage said shoulder, but rest on the tooth back of it. This is necessary as the detent 34 is raised and let fall before the cam 32 sets free the striking mechanism.

In place of releasing the striking mechanism at the fan 30 and locking same by the striking-plate the train may be let off and locked by the striking-plate alone through a detent which is operated by an electromagnet. Such a construction is illustrated in Fig. 6. Q is an electromagnet controlled from the going-circuit and excited at each hour, and *q* is its armature, attached to the detent-lever 34ª, carrying the detent 34, engaging the teeth on the striking-plate, as in Fig. 5. It will be obvious without further illustration that the striking is controlled wholly by the magnet Q. This means of controlling the striking mechanism is especially useful in cases where it is not convenient to take the going-circuit as far as the governing-dial.

Obviously this invention is not limited, strictly, to the particular construction of the details herein shown, as these may be varied considerably without departing materially from our invention.

Having thus described our invention, we claim—

1. The combination in an electric-clock system, of a controlling, primary clock adapted to be wound at intervals by electromagnetic means, a going-circuit and generator, and a plurality of secondary clocks in said going-circuit, of a striking-circuit and generator, a plurality of electric annunciators in said striking-circuit situated adjacent to the respective secondary clocks, and a secondary clock

in both circuits provided with means for controlling the said striking-circuit, substantially as set forth.

2. The combination in an electric-clock system, of a controlling, primary clock, adapted to be wound at intervals by electromagnetic means, a plurality of secondary clocks, a secondary clock A^2, having means for automatically setting right the secondary clocks in the system, a main operating or going circuit controlled by the primary clock, a striking-circuit, for striking the hours, a secondary clock A^3, controlling said striking-circuit, and the electric annunciators in said circuit, substantially as set forth.

3. The combination in an electric-clock system, of the operating or going circuit, a primary clock controlling said circuit and adapted to be wound up at intervals by electromagnetic means, and a secondary clock in said circuit, said clock comprising a magnet N, in the operating-circuit, a vibratable armature *n* therefor, an escapement-anchor carried by said armature, an escapement-wheel, the teeth of which are engaged by said anchor, a ratchet-wheel, loose on the arbor of the escapement-wheel and connected thereto by a spring, a pawl carried by the armature and engaging the teeth of said ratchet-wheel, and a clock-train driven from the arbor of said escapement-wheel, substantially as set forth.

4. The combination, in an electric-clock system, of a controlling primary clock A, a going-circuit and generator, a plurality of secondary clocks in said going-circuit and controlled by the primary clock, one of said secondary clocks, next to the primary clock having mechanism for controlling the setting of the secondary clocks, said mechanism consisting of a shunting-switch adapted, when uncontrolled, to switch the secondary clocks beyond it, out of the going-circuit, a pawl-arm which swings radially about the central, hand-arbor of the clock and has a spring whereby said arm holds said shunting-switch closed, normally, to the secondary clocks, a ratchet-wheel 24, carried by the minute-hand of the clock, a pawl carried by said pawl-arm and engaging said ratchet-wheel, a ratchet-wheel 24^a, fixed on the center arbor, and a pawl carried by the pawl-arm and engaging said ratchet-wheel, whereby when the minute-hand is set back it allows the shunting-switch to cut out all of the other secondary clocks from the circuit, substantially as and for the purposes set forth.

5. The combination, in an electric-clock system, of a primary controlling-clock, actuated by electromagnetic means, a going-circuit and generator, a plurality of secondary clocks in said going-circuit, a striking-circuit including a generator and electric annunciators at the respective secondary clocks, and a striking mechanism in one of said secondary clocks and controlling said secondary circuit, said striking mechanism comprising a striking-plate 27, a toothed wheel 28, connected to and rotating therewith, a cam 32, carried by the minute-hand of the clock, a detent 34, engaging the teeth of the striking-plate and controlled by the cam 32, a weighted pawl-arm 29, mounted to swing radially about the arbor of the striking-plate and having a contact-arm 29^a, a pawl 29^c, carried by the arm 29 and engaging the teeth of the wheel 28, an electromagnet P in the striking-circuit and its armature-lever *p*, said lever being adapted to contact with the arm 29^a of the weighted pawl-arm and close the striking-circuit whenever the weighted lever descends to the predetermined extent, substantially as set forth.

In testimony whereof we have signed our names to this specification in the presence of the subscribing witnesses.

FRANK HOPE-JONES.
GEORGE BENNETT BOWELL.

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