(No Model.) 3 Sheets—Sheet 1.

G. W. MacKENZIE.

ELECTRIC CALENDAR CLOCK.

No. 574,922. Patented Jan. 12, 1897.

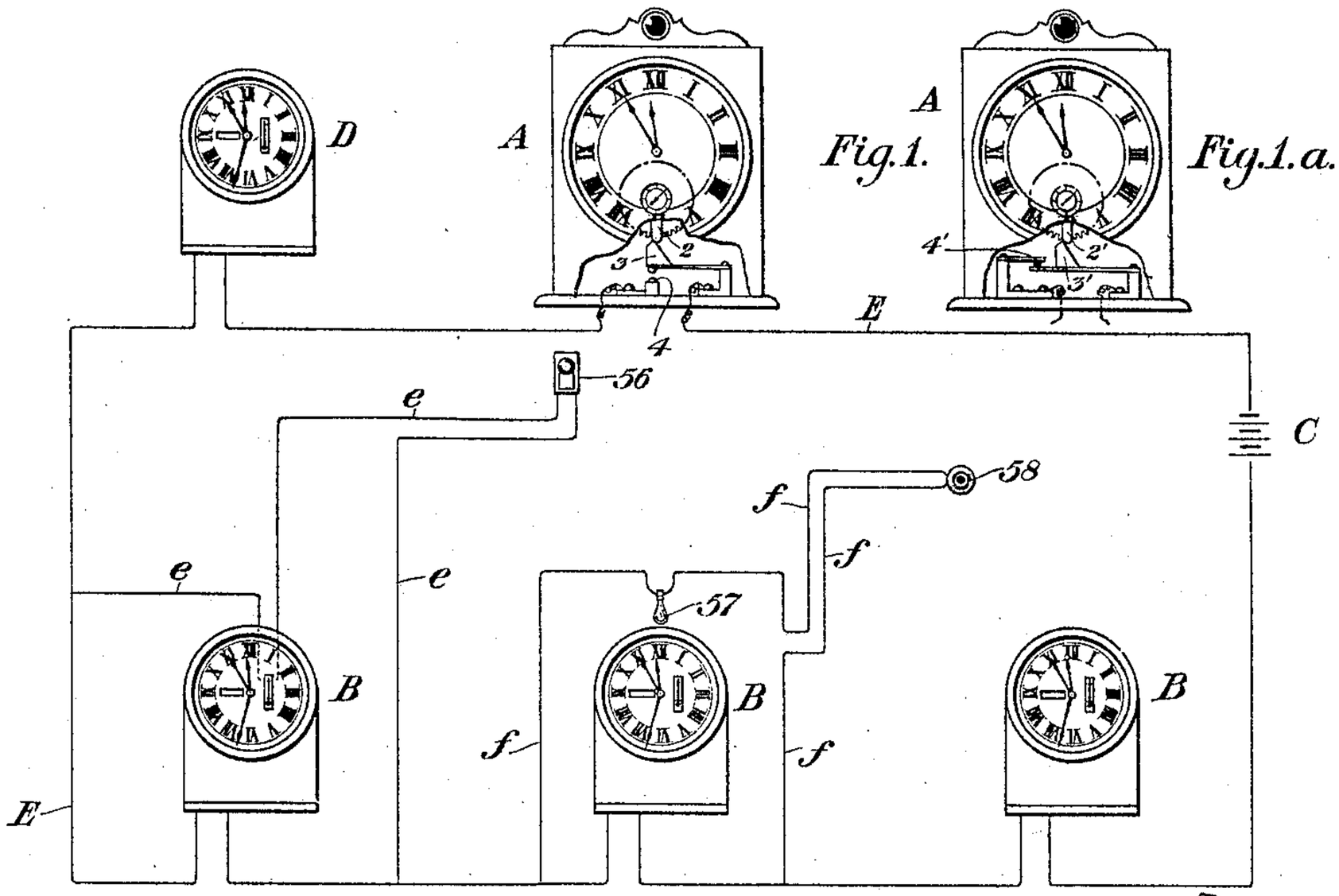


Fig. 1.

Fig. 1.a.

Fig. 2.

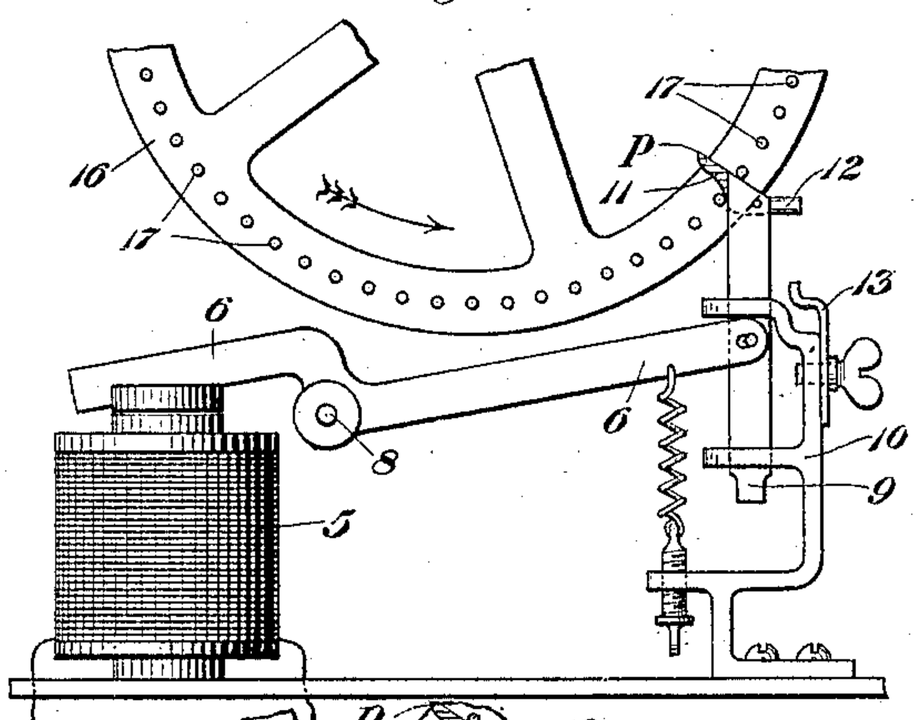


Fig. 3.

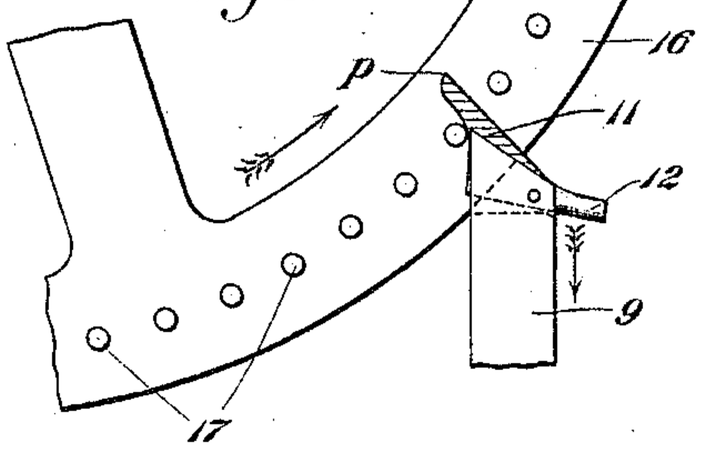


Fig. 4.

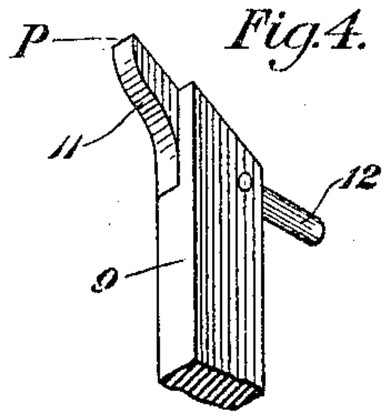


Fig. 5a.

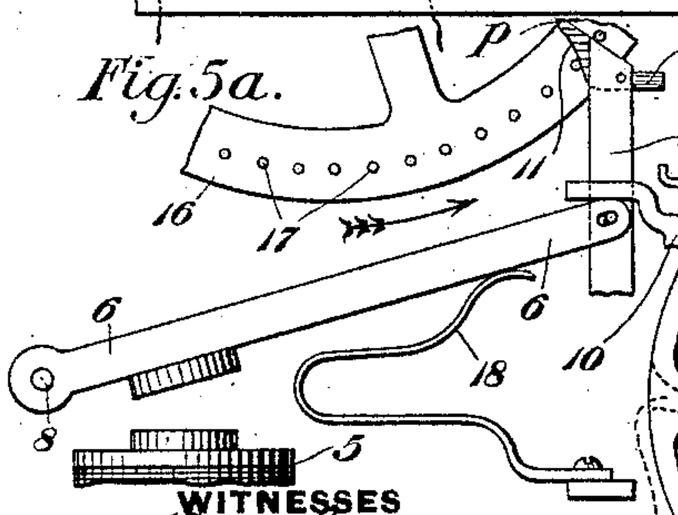
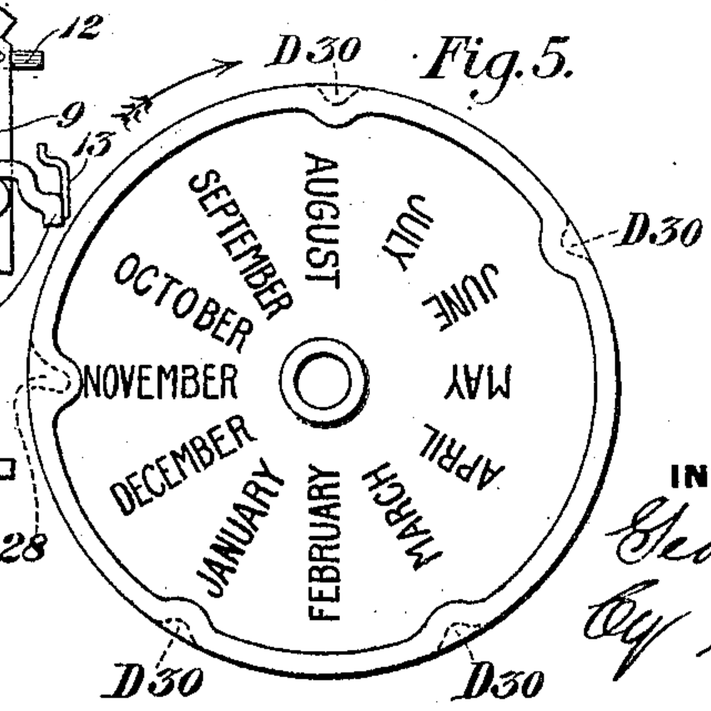


Fig. 5.



WITNESSES

V. J. Shepard.

S. A. Clarke

INVENTOR

George W. Mackenzie

by O. M. Clarke

his attorney.

(No Model.) 3 Sheets—Sheet 2.

G. W. MacKENZIE.

ELECTRIC CALENDAR CLOCK.

No. 574,922. Patented Jan. 12, 1897.

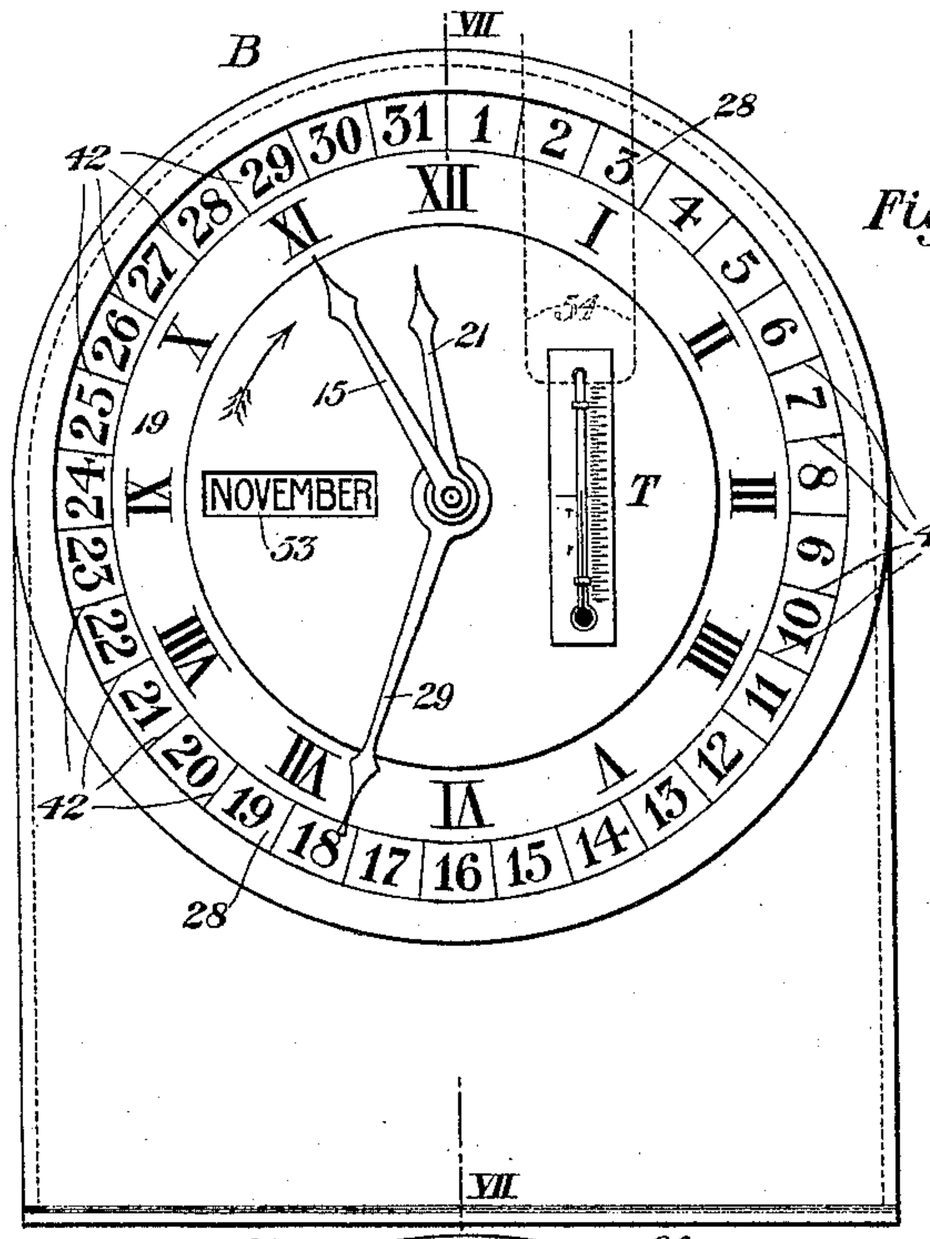


Fig.6.

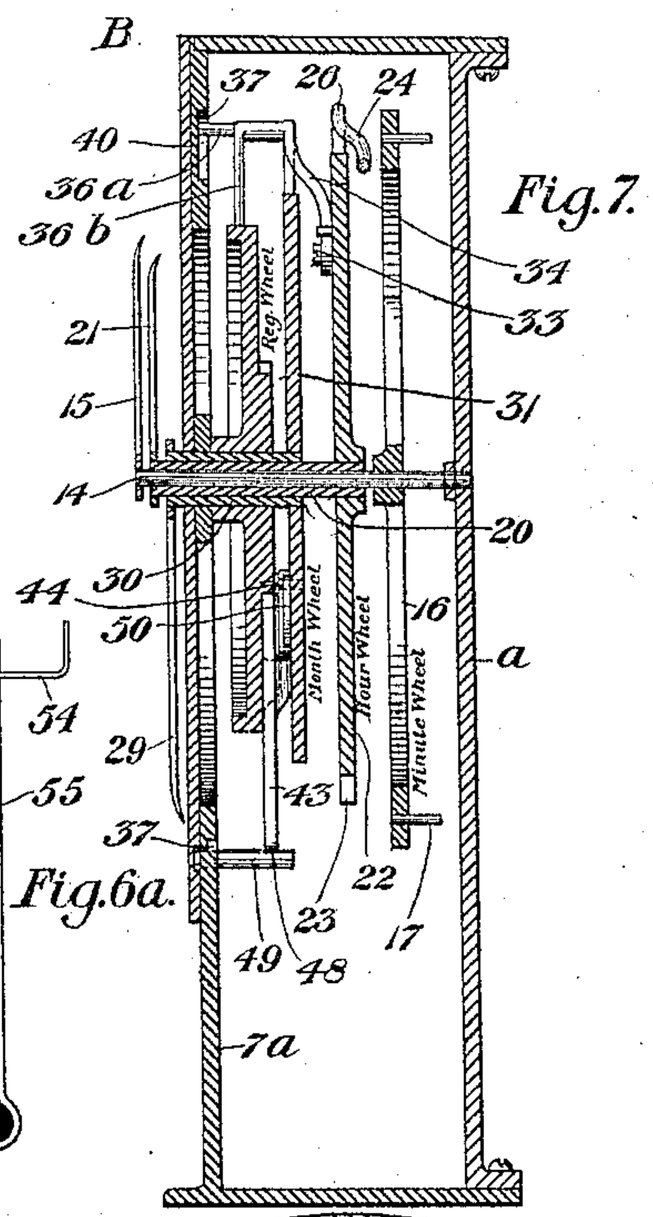


Fig.7.

Fig.6a.

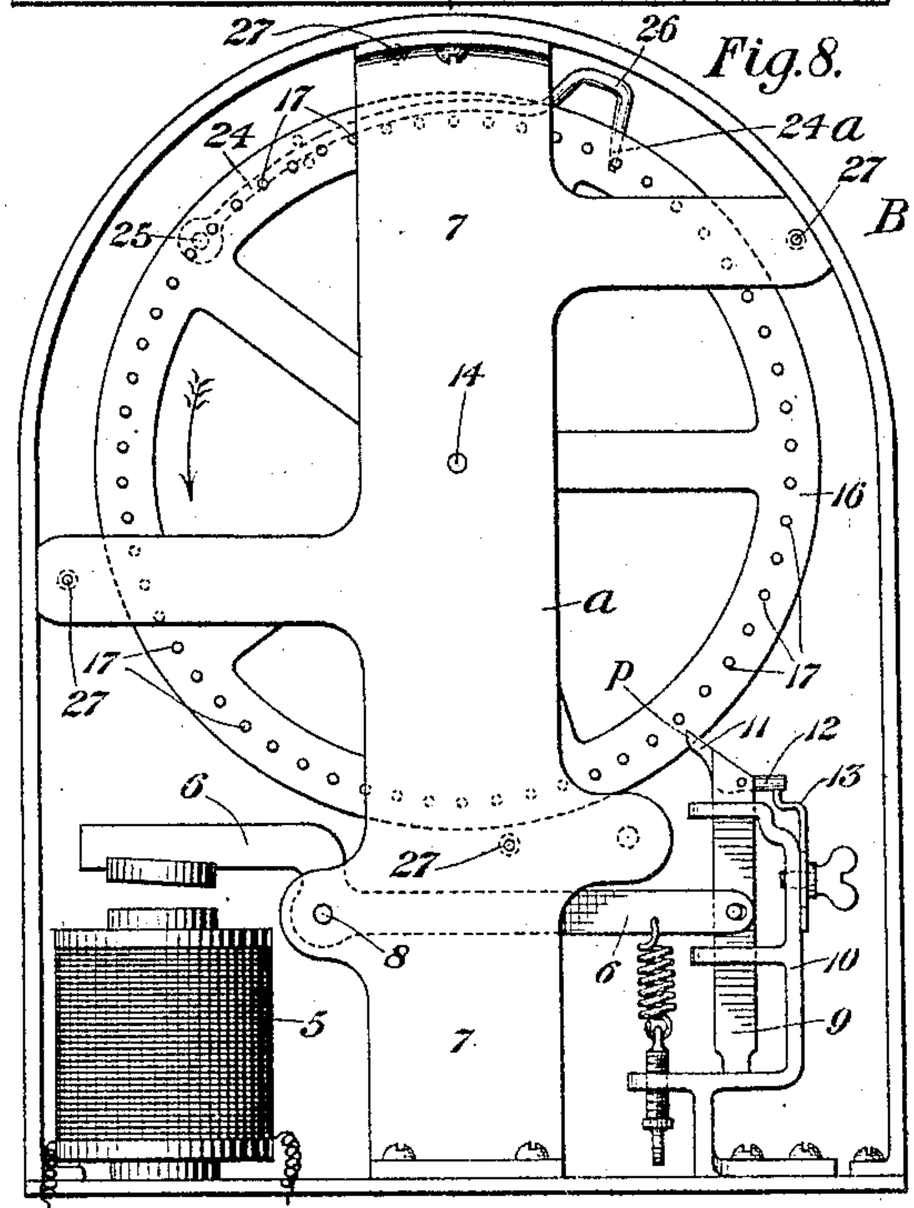


Fig.8.

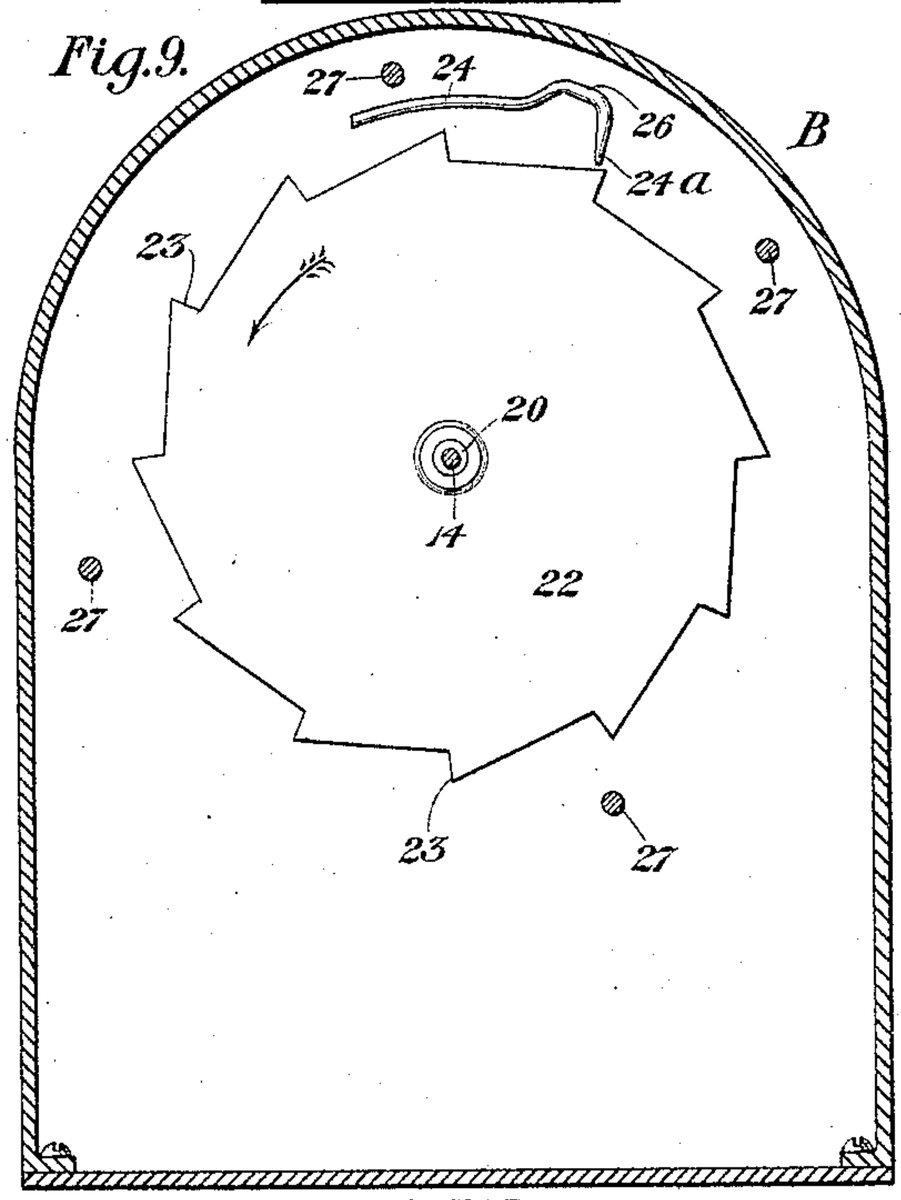


Fig.9.

WITNESSES

F. J. Shepard.

L. A. Clarke

INVENTOR

George W. Mackenzie

by E. M. Clarke

his Attorney.

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G. W. MacKENZIE.

ELECTRIC CALENDAR CLOCK.

No. 574,922. Patented Jan. 12, 1897.

Fig. 10.

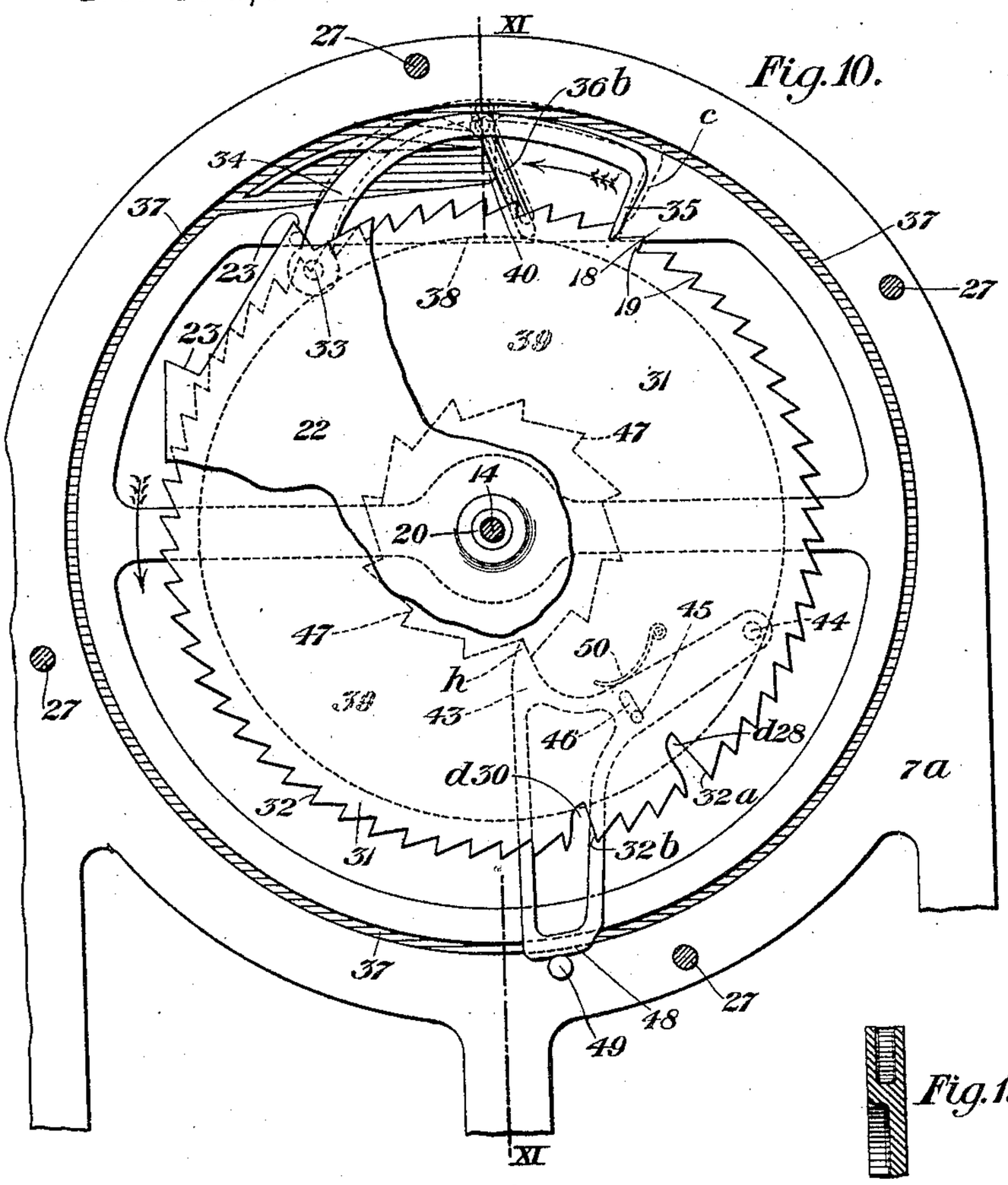


Fig. 11.

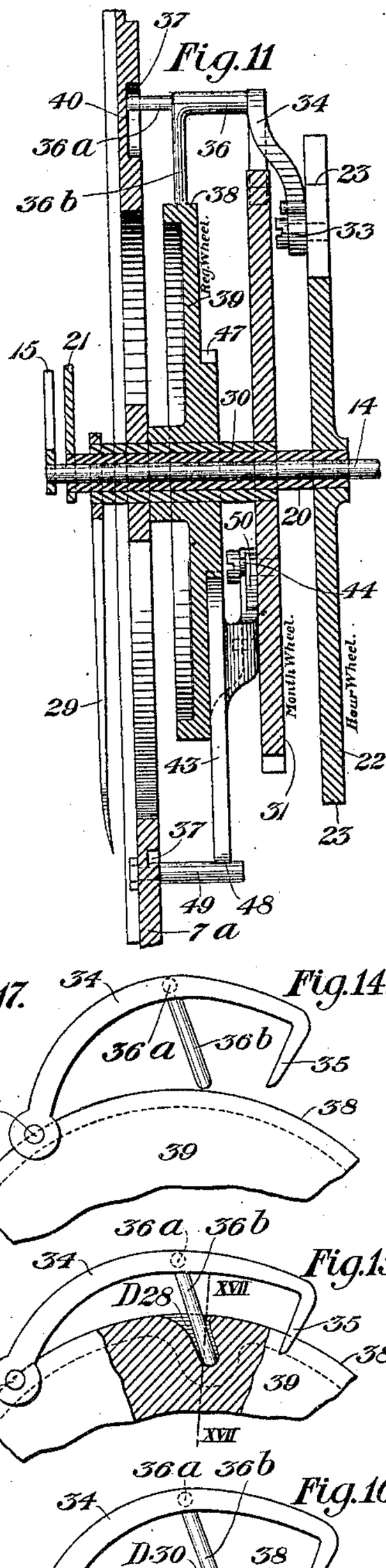


Fig. 17.

Fig. 14.

Fig. 12.

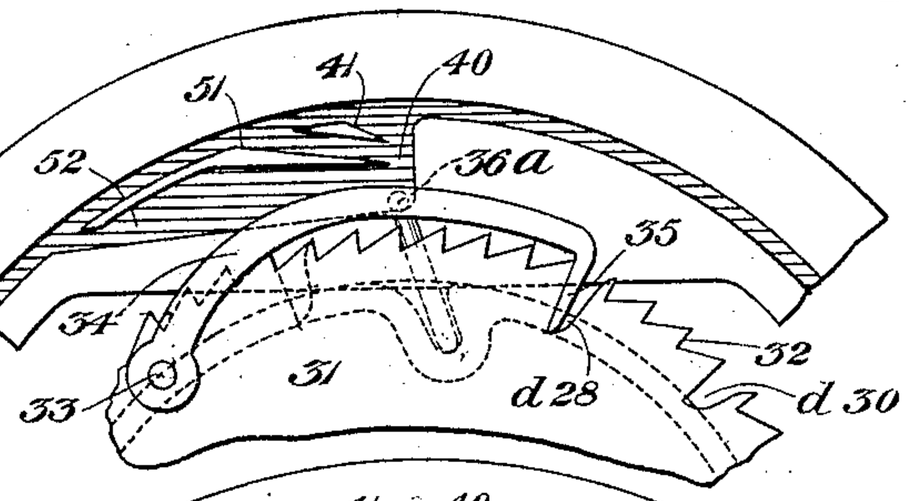


Fig. 15.

Fig. 13.

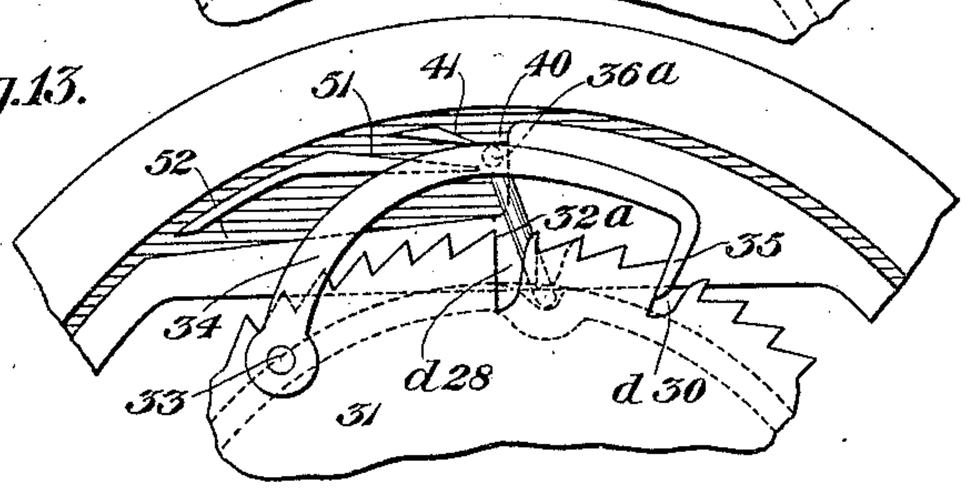
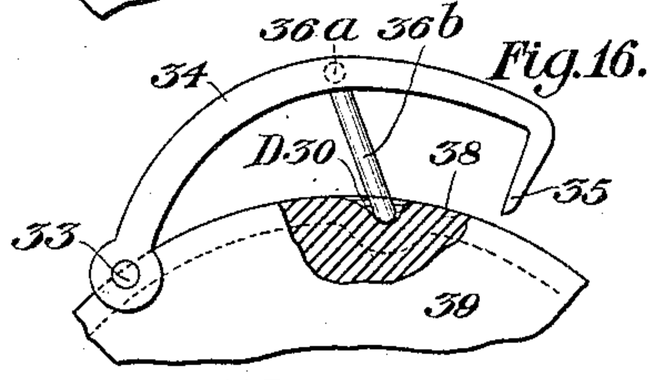


Fig. 16.



WITNESSES

V. K. Shepard.

S. A. Clarke

INVENTOR

George W. MacKenzie

by O. M. Clarke

his Attorney

UNITED STATES PATENT OFFICE.

GEORGE W. MACKENZIE, OF BEAVER, PENNSYLVANIA.

ELECTRIC CALENDAR-CLOCK.

SPECIFICATION forming part of Letters Patent No. 574,922, dated January 12, 1897.

Application filed December 28, 1895. Serial No. 573,684. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. MACKENZIE, a citizen of the United States, residing at Beaver, in the county of Beaver and State of Pennsylvania, have invented or discovered a new and useful Improvement in Clocks, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a diagrammatic view in elevation showing a system of master and secondary clocks arranged in accordance with my invention. Fig. 2 is a detail view illustrating the magnet-actuated shifting device in a raised position and locking the minute-wheel. Fig. 3 is a detached detail view of part of the minute-wheel, showing the shifting pawl receding from engagement with the spacing-pins. Fig. 4 is a detail view in perspective of the shifting pawl. Fig. 5 is a face view of the wheel bearing the names of the months. Fig. 5ª is a view similar to Fig. 2, but showing a different arrangement of armature-bar for effecting an unlocking and feeding action only when the magnet is energized. Fig. 6 is a view in front elevation of one of the secondary clocks employed in my system. Fig. 6ª is a detail view of a thermometer supplied with terminals for mercury-contact. Fig. 7 is a sectional view taken on the line VII VII of Fig. 6. Fig. 8 is a view of the clock from the back. Fig. 9 is a similar view in which the minute-wheel and part of the frame has been detached, exposing the hour-wheel. Fig. 10 is a back view, partly broken away, on an enlarged scale, of a secondary clock, showing the mechanism for imparting motion from the month-wheel to the regulating-wheel. Fig. 11 is a vertical section through Fig. 10 on the line XI XI of Fig. 10. Figs. 12 and 13 are partial views similar to Fig. 10 and illustrating the parts in different positions of operation. Figs. 14, 15, and 16 are detail views showing the feeding-pawl for the month-wheel in different positions as controlled by the regulating-wheel. Fig. 17 is a vertical sectional detail view through the flange of the regulator-wheel, taken on the line XVII XVII of Fig. 15.

Similar letters and numerals of reference refer to like parts wherever used throughout this specification.

My invention relates to the art of controlling a system of secondary clocks from a central or master clock; and it consists particularly in the mechanism employed in the secondary clocks, by means of which, through an intermittently-energized electromagnet acting through such mechanism, the hands of the clock are caused to record time in conformity with the hands of the master-clock, and in certain other features of construction which shall be more fully hereinafter set forth.

Referring now to the drawings, A represents the master-clock, located at any convenient central station and regulated to run accurately in the customary manner by the ordinary works usually employed in clocks.

Secured to any suitable wheel or part of the works, preferably to the minute-hand, is a small trip 2, which makes contact once every minute with the spring 3, depressing it and making electrical contact with the button 4, which, with the spring 3, constitute the terminals of a circuit E, connecting all of the branch clocks B with the master-clock A and a source of electrical energy C.

Each of the secondary clocks B is furnished with an electromagnet 5, located within the casing, so as to attract, when energized, the armature-bar 6, pivoted in the frame 7 at 8. It is connected at the other end with a vertical reciprocating shifting arm 9, mounted in the guide 10 and having at its upper end a pivoted dog 11, provided with an outwardly-extending finger 12, which in the lower position of the arm 9 strikes against the adjustable stop 13, thus throwing the point *p* down into the position shown in Fig. 8.

Mounted in the frame 7 is the main shaft 14, to the outer end of which is secured the minute-hand 15, and on the inside, in close proximity to the shifting arm 9, is the wheel 16, secured to the shaft 14 and furnished with sixty outwardly-projecting pins 17. In the upward travel of the shifting arm 9 the point *p* of the dog 11 will engage one of these pins 17 and cause it to advance a distance equal to the space between two pins, as shown in Fig. 2, the dog 11 wedging itself, as shown, between two pins and effectually locking the

wheel 16 against movement until the dog is withdrawn. This motion of the arm 9 is due to the energizing of the magnet 5 by the closing of the circuit through the mechanism in the master-clock A, already described, and such magnetization imparts motion to the shifting arm 9 through the armature-bar 6 either to raise the bar and shift the wheel and immediately withdraw the dog from engagement, as is the case in the form shown in Fig. 8, or, as is preferable, by withdrawing the bar and immediately allowing it to reseat itself under action of the spring 18, as shown in Fig. 5ª. In this manner the dog 11 will remain in engagement between the pins 17, effectually locking the wheel 16 against motion for fifty-nine seconds until rotated a partial revolution, as described, in regularity with the motion of the trip 2 in the master-clock. If desired, this trip may be made to break the electrical contact instead of closing it, thus leaving a current established through the system of secondary clocks and applied through the arrangement shown in Fig. 8 for fifty-nine of the sixty seconds, thus holding the dog in engagement for a corresponding period, until the current is broken by the trip 2. It will thus be seen that inasmuch as there are sixty pins 17 on the wheel 16, and each pin is advanced one space for each minute as measured by the master-clock, the wheel 16 will be caused to make one entire revolution for each hour, and in consequence the hand 15 will travel around on the face 19 of the clock, intermittently, in steps of one minute each.

I shall now describe the mechanism for recording the hours, which, as are all the subsequent operations, is dependent on the initial movement of the wheel 16.

Surrounding the shaft 14 is a sleeve 20, carrying at its outer end an hour-hand 21 and having secured to its inner end a wheel 22, provided with twelve ratchet-teeth 23. A spring-pawl 24 is pivoted at 25 to wheel 16 and is provided with an outwardly-projecting cam extension 26, which comes into contact with four cross-rods 27, so located as to engage and depress the pawl 24, making the point 24ª engage with the tooth 23 for a sufficient space of time to rotate the periphery of the wheel 22 one-fourth of the distance between each successive tooth 23, the rods 27 being so located as to depress the pawl at the proper time to engage and release the tooth 23 in its successive positions as advanced by the previous action of the last depression of the pawl. In this manner the wheel 22 is caused to make the one-twelfth of a revolution each hour in four steps of one forty-eighth of a revolution each, thus causing the hour-hand to travel over the space intervening between any two hours and to assume in relation to the minute-hand an approximately proper position at the proper time.

Surrounding the hourly divisions on the clock-face is an annular ring 28, on which is inscribed the numbers corresponding to thirty-one equal divisions of the ring, and on which, by means of a hand 29, is indicated the day of the month by the mechanism I shall now describe.

Surrounding the sleeve 20 is another sleeve 30, to which is secured at the outer end the hand 29 and on the inner end the wheel 31, having cut into its periphery sixty-two equally-spaced ratchet-teeth 32, two of which, 32ª and 32ᵇ, are of greater depth than the other teeth for the purposes I shall hereinafter describe.

Pivotally secured to the wheel 22 at 33 is the pawl-arm 34, provided with the downwardly-directed hook 35, and projecting back from the arm 34 is an extension 36, two branch pins of which, 36ª and 36ᵇ, engage in the cam-groove 37 and rest on the flange 38 of the regulating-wheel 39, respectively. The groove 37 is made in the face of the frame 7ª and is made circumferential for the greater part of its length, serving as a guide for the end of the pawl-arm-extension pin 36ª and holding the hook 35 out of engagement with any of the teeth of the wheel 31, as indicated by dotted lines at *c*, Fig. 10, until in the forward travel of the pawl due to the rotation of the wheel 22 the extension 36ª will fall by gravity into the vertical slot 40 until arrested by the downwardly-projecting extension 36ᵇ striking on the flange 38 of the regulator-wheel 39, as shown in full lines in Fig. 10. In this position, which is the one employed in all cases except as in those of months of twenty-eight and thirty days, when it is desired to move the wheel sufficiently far to make the hand 29 pass over the intervening space and arrive at the first of the next month the pin 36ª will drop into the position shown in Fig. 10 and no farther, on account of the pin 36ᵇ striking on the flange 38. Now in the forward motion of the pawl in the direction of the arrow the pin 36ª will strike onto and ride up on the cam-face 41, which is of just sufficient length to keep the hook 35 in engagement with the tooth 32 to move it the space of one tooth. As the wheel 22 makes two revolutions for each twenty-four hours this operation will be performed twice, and the wheel 31, having sixty-two teeth, will be caused to rotate a distance equal to one thirty-first of its circumference, resulting in the hand 29 being moved on the annular ring 28 a space corresponding to one day of the month. It will be seen that in such movement the point of the hand will rest at two points between the division-lines 42 on the ring due to the intermittent motion, and the changes will be made at the hours of twelve midnight and twelve noon, thus pointing during the morning hours to the first half of the division and during the afternoon hours to the last half.

As already suggested, it will be necessary in cases of months having a less number of days than thirty-one to cause the pawl 34 to

carry the wheel 31 around sufficiently far to bring the hand 29 to the first of the ensuing month, and this result is secured by means of the regulator-wheel 39, which makes one complete rotation in each year. This rotation is effected by means of a ratchet-hook 43, pivoted to the wheel 31 at 44, its swinging motion being limited by a pin 45 in the slot 46.

Twelve ratchet-teeth 47 are made on the inside face of the wheel 39, and the hook 43 is provided with an extended cam-face 48, which comes into contact with a pin 49, secured in the frame, throwing the hook into engagement with one of the teeth 47, and the face of the cam 48 is of sufficient length to keep it in engagement with the tooth 47 until it has been rotated one-twelfth of a revolution, when the hook 43 will be thrown out of engagement by the spring 50. Inasmuch (as has been shown) as the wheel 31 makes two intermittent motions under action of the pawl 34, the motion of the regulator-wheel will be correspondingly intermittent and in conformity with the wheel 31 as long as the hook 43 is in engagement with the teeth 47.

At certain positions on the flange 38 of the regulating-wheel 39 are pockets D^{28} and D^{30}, arranged so as to come into register with the pin 36^b at such times as it becomes necessary to move the wheel 31 more than one space, so as, for instance, to turn the hand 29 from the twenty-eighth or thirtieth day of the month to the first. These pockets are of two depths, as shown, and their location around the periphery of the regulator-wheel is determined and arranged so as to permit the pin 36^b to fall until the hook 35 has engaged one of the extra-deep depressions d^{28} and d^{30}, according to the desired change, when the pin 36^a will be caused to drop a corresponding distance down in the slot 40 and in its forward motion will ride up the face of the cam 51 or 52 and into the slot 37, when the wheel 31 will have been rotated a sufficient distance to make up the difference between the months shorter than thirty-one days and the first of the next month. It will thus be seen that the operations of the wheel 31 and regulator-wheel 39 are independent, the flange 38 serving as a stop to limit the fall of the pawl 34, so that the pin 36^a will ride up the cam 41, controlling the shortest movement of the wheel 31, corresponding to one day, as from the thirty-first day to the first day. Likewise the pockets D^{28} and D^{30}, by allowing the pawl 34 to fall into deeper spaces d^{28} and d^{30}, and consequently the pin 36^a to also fall sufficiently low to engage the cam 51 or 52, will result, as already shown, in feeding the wheel 31 around sufficiently far to move the hand 29 from the thirtieth or twenty-eighth day, as the case may be, to the first. Thus the regulator-wheel in its successive movements will correctly govern the operation of the pawl 34 on the month-wheel 31, and will itself be correctly operated by said wheel 31, resulting in the correct indication of the day of the month for each month throughout the year.

For the purpose of indicating the name of the month on the face of the clock the months are affixed to the face of the indicator-wheel in rotation, as shown in Fig. 5, the proper name showing through the opening 53. The previous explanation will readily make it clear that the revolution of the regulator-wheel will bring into view the name of the proper month at the proper time.

An additional feature of construction consists in a thermometer T, affixed to the face of the clock, as shown in Fig. 6, for indicating the temperature, and I have devised, in combination with the thermometer, a convenient means for indicating an unusual rise in the temperature in the immediate proximity of the clock, consisting in a branch circuit *e*, the terminals 54 of which are introduced within the tube 55 of the thermometer, so that the mercury, when expanded by an unusual heat, will make contact between them and establish electrical communication through the bell 56, which may be located in close proximity to the master-clock, and thus give notice of such change in temperature, as in case of fire.

If desirable, as in the case of hotels or other large buildings, the various branch clocks may be connected with an alarm provided with an indicator such as is commonly employed in such practice.

An additional feature of advantage consists in the use of an electric lamp 57, in electrical communication by branch wires *f* with the main circuit E through a button 58, which may be located at any convenient point, as, for instance, beside a bed, so that by pressing the button the face of the clock may be illuminated at night and clearly seen.

Other features of improvement and modification may be introduced into the construction of the secondary clock, as, for instance, by the use of proper additional mechanism the day of the week may be indicated in a manner similar to the method of indicating the months.

Changes and modifications may be made in the construction and operation in other respects by the skilled mechanic without departing from my invention, as I do not desire to be limited to the exact construction shown in the drawings.

My invention is capable of application in many and various cases, from a residence, office building, or factory to an entire town or city, and the advantages of a complete, reliable, and accurate system of time-keeping in such varied application will readily be appreciated.

Having described my invention and in what manner it operates, what I claim, and desire to secure by Letters Patent, is—

1. In a secondary clock, in combination with an intermittently-electrically-actuated

minute-wheel mounted on a shaft, carrying a minute-hand, an hour-wheel intermittently actuated by a pawl attached to the minute-wheel mounted on a hollow sleeve surrounding the minute-wheel shaft and carrying the hour-hand, and a month-wheel intermittently actuated by a pawl attached to the hour-wheel, mounted on a hollow sleeve surrounding the hour-hand sleeve, and carrying the day-of-month hand; the regulator-wheel 39 provided on the inside with ratchet-teeth 47 designed to be engaged by the intermittently-actuated hooked pawl 43, pivotally attached to the month-wheel and designed to bear against a fixed pin 49 at one period of its revolution, the regulator-wheel bearing on its face the names of the months in rotation and having pockets in its periphery of varying depths, for the purposes described.

2. A secondary clock having a minute-wheel provided with a series of equally-spaced pins located in a circle and projecting out from the face of the wheel: an inclined-faced pawl pivotally secured at the top of an electrically-actuated reciprocating bar, designed to engage one of the pins and advance it and the wheel one space, to lock the wheel against movement by such insertion between the pins, and to be retracted for another stroke, the pivoted pawl riding over the next pin and assuming a working position, substantially as set forth.

3. As a device for shifting the minute-wheel, an electrically-actuated reciprocating bar mounted in guides, an inclined-faced pawl pivotally secured to the top of such bar provided with a tailpiece and an adjustable stop secured on the guide-frame and designed to engage the tailpiece and return the pawl to a normal position, substantially as set forth.

4. In a secondary clock of the class described, having an electrically-actuated minute-wheel, an hour-wheel, a month-wheel and a regulating-wheel, a pawl attached to the hour-wheel for imparting motion to the month-wheel by engaging teeth therein provided with a downwardly-projecting pin bearing on the flange of the regulator-wheel, and a pin projecting into a main cam-groove, in the frame of the clock, such groove holding the pawl out of engagement with the teeth of the month-wheel until it falls into a slot forming part of the cam to the level of certain other inclined cams leading back into the main cam-groove, such fall of the pawl being controlled by pockets in the flange of the regulator-wheel located in the path of the downwardly-projecting pin, substantially as set forth.

5. In combination with the hour-wheel 22 and its attached pawl-arm 34 provided with a pin 36^a traveling in a cam-groove 37 in the frame of the clock, and a downwardly-projecting pin 36^b for the purposes described: a month-wheel 31 provided with sixty-two ratchet-teeth, two of which 32^b and 32^a have corresponding depressions d^{30} and d^{28} of a greater depth than the depth of the other ratchet-teeth spaces, substantially as and for the purposes set forth.

6. In a secondary clock, the combination with a stationary cam-groove 37 provided with the vertical way 40 and secondary cam-faces 41, 51, and the intermittently-actuated regulator-wheel 39 provided with pockets in its periphery of varying depths: of the intermittently-actuated hour-wheel 22 and a pawl-arm 34 pivotally attached thereto provided with a hook 35, a pin 36^b bearing on the periphery of the regulator-wheel 39, and a pin 36^a traveling in the cam-groove 37, substantially as and for the purposes set forth.

In testimony whereof I have hereunto set my hand this 16th day of November, 1895.

GEORGE W. MACKENZIE.

Witnesses:
PETER J. EDWARDS,
W. P. HANNA.