(No Model.) 3 Sheets—Sheet 1.

H. C. KARR.

ELECTRIC CIRCUIT CLOSER FOR CLOCKS.

No. 428,676. Patented May 27, 1890.

FIG. I.

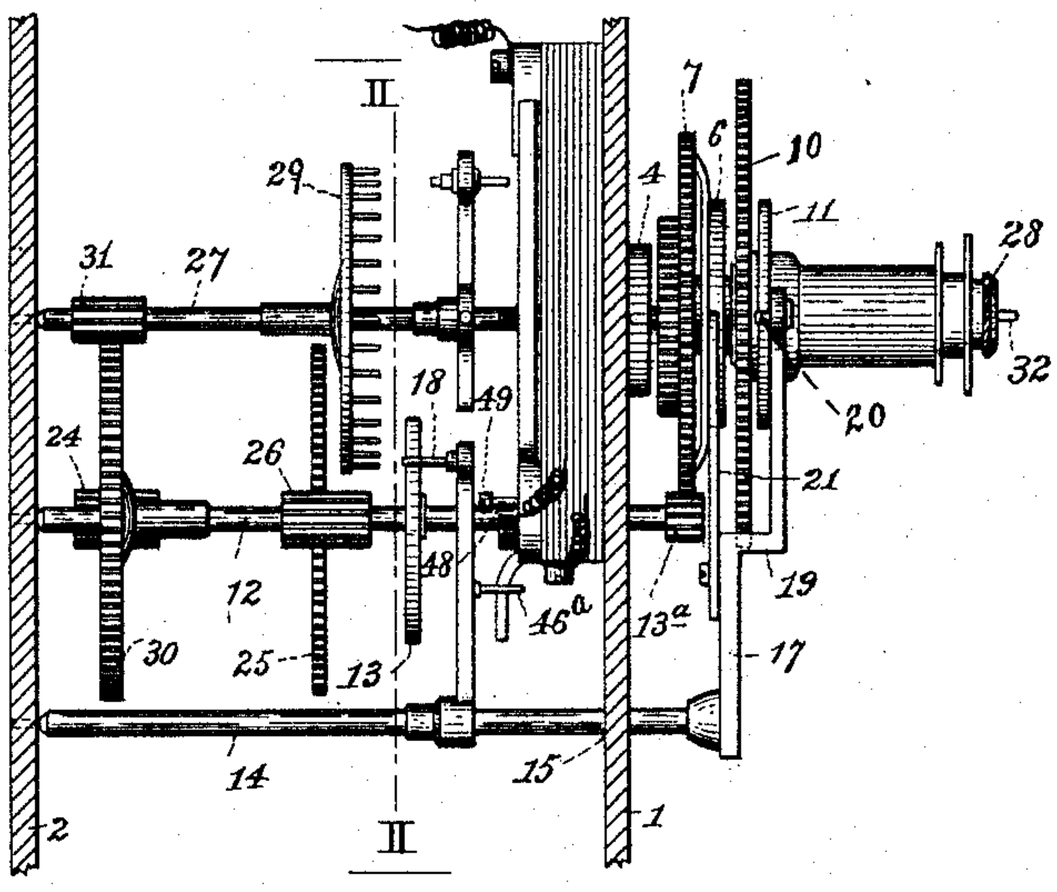


FIG. II.

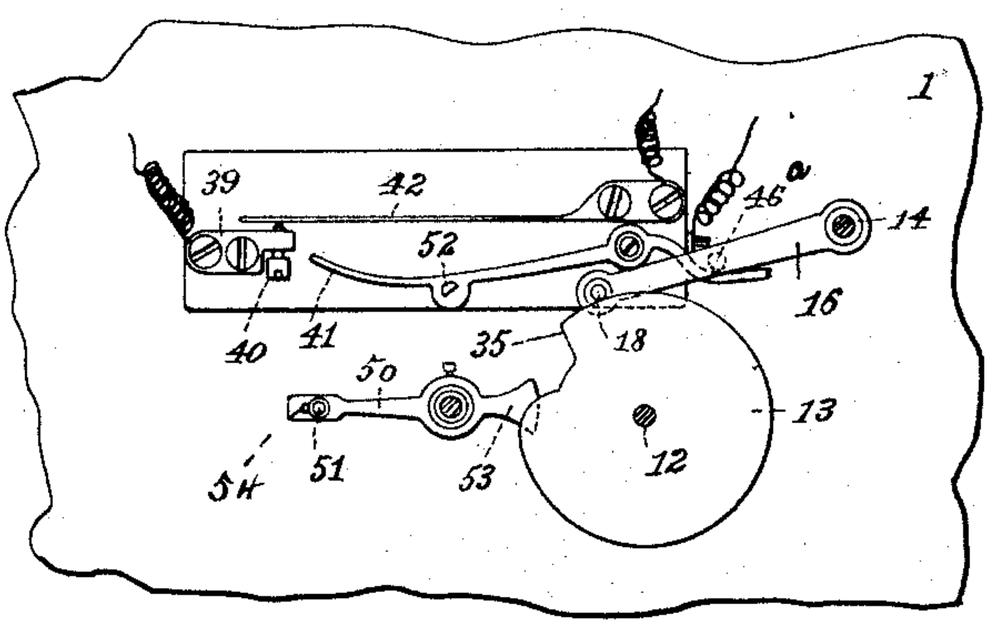
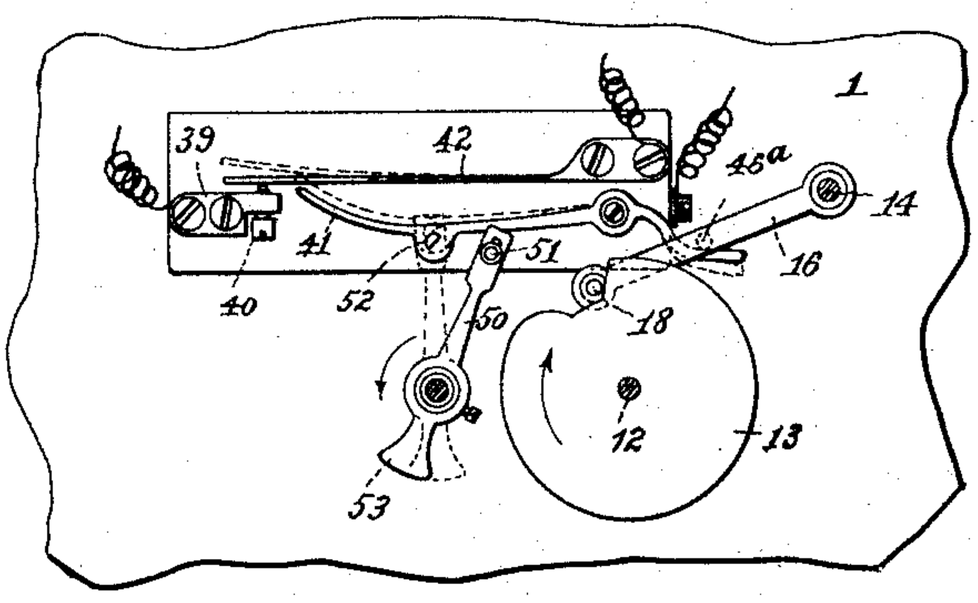


FIG. III.



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Jas. K. McCathran

Inventor

Henry C. Karr.

by F. A. Hopkins

atty.

(No Model.) 3 Sheets—Sheet 2.

H. C. KARR.

ELECTRIC CIRCUIT CLOSER FOR CLOCKS.

No. 428,676. Patented May 27, 1890.

FIG. IV.

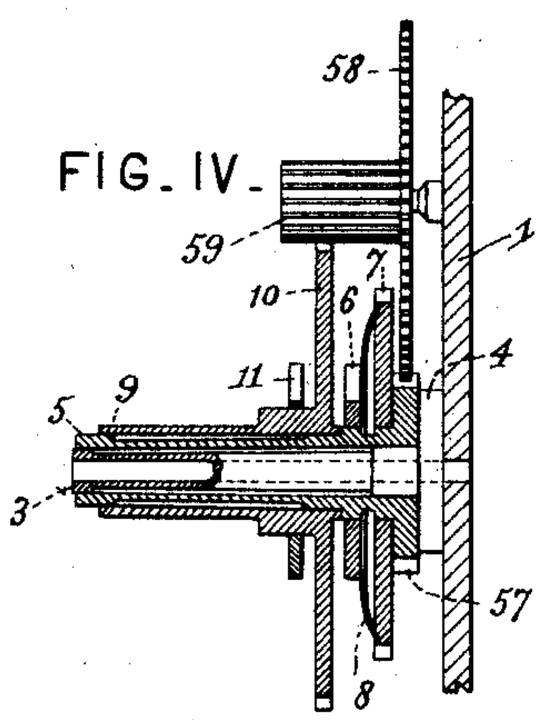
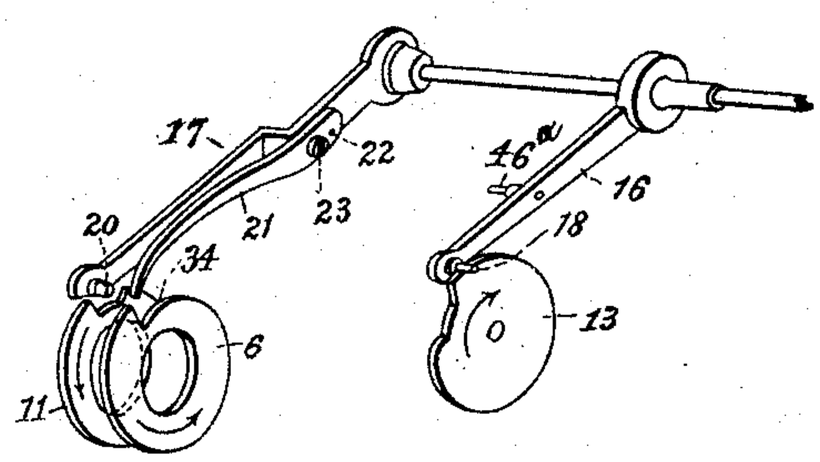


FIG. V.



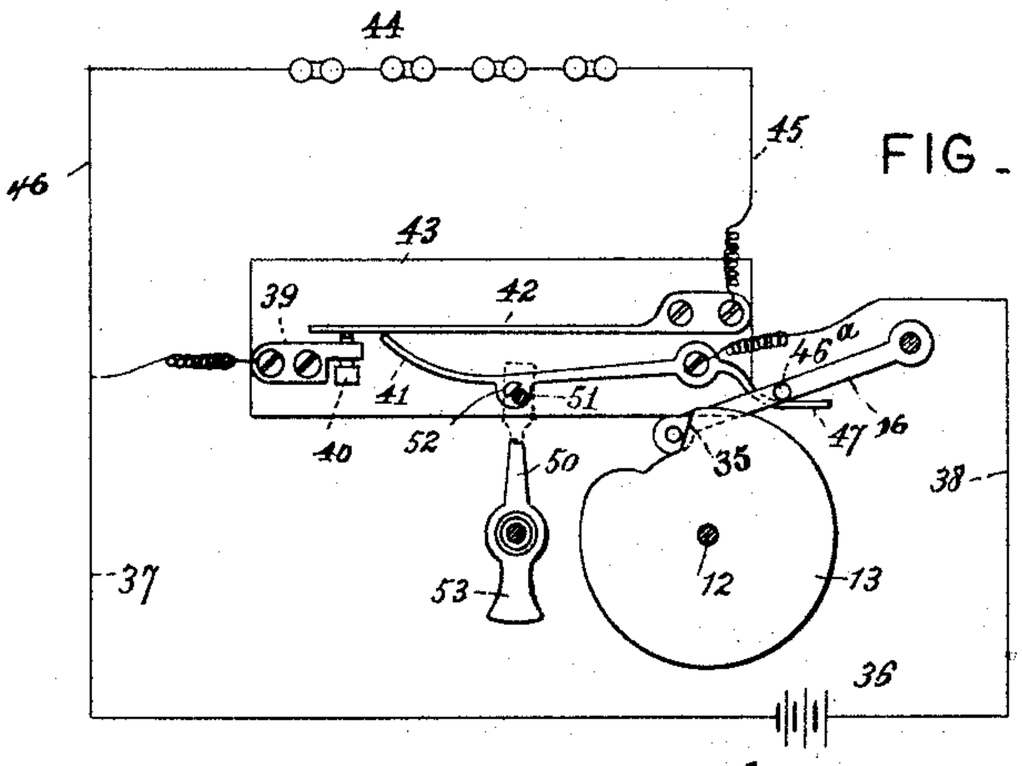


FIG. VI.

FIG. VIII.

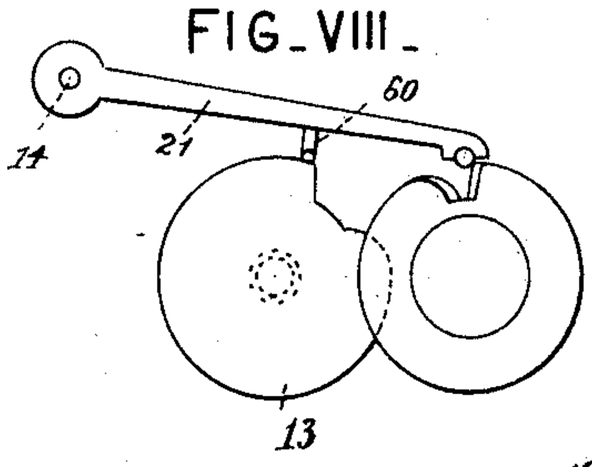


FIG. VII.

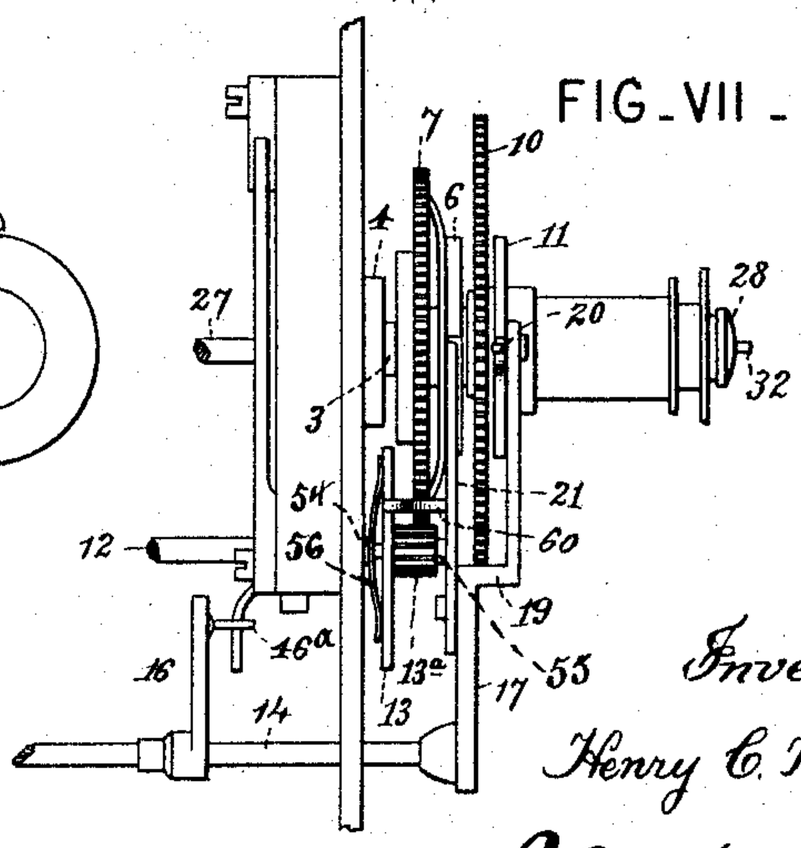


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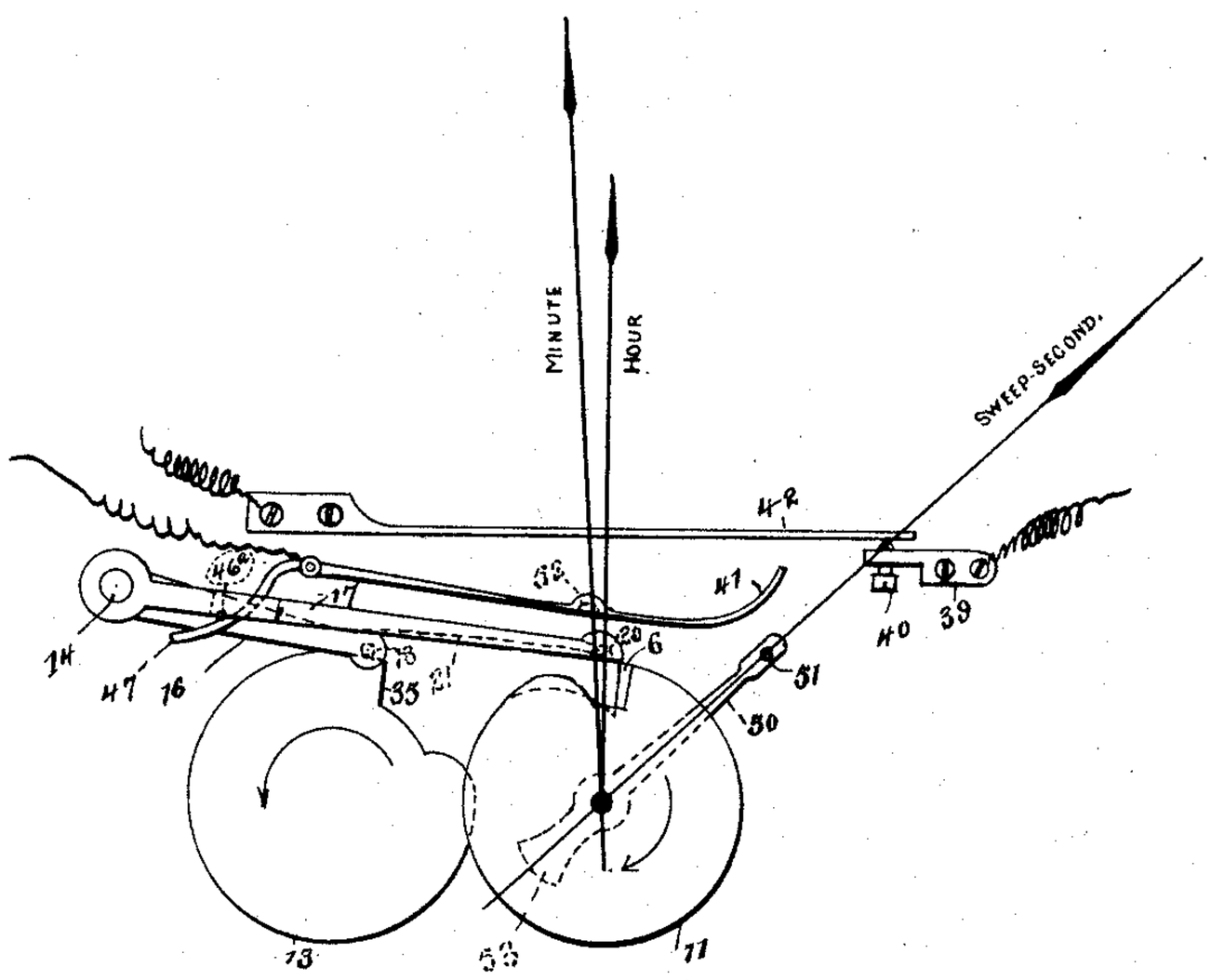
FIG. IX.



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UNITED STATES PATENT OFFICE.

HENRY C. KARR, OF WASHINGTON, DISTRICT OF COLUMBIA.

ELECTRIC-CIRCUIT CLOSER FOR CLOCKS.

SPECIFICATION forming part of Letters Patent No. 428,676, dated May 27, 1890.

Application filed February 14, 1889. Serial No. 299,839. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. KARR, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Electric-Circuit Closers for Clocks, of which the following is a full, clear, and exact specification, reference being had to the accompanying drawings, which form an important part of this application.

My invention relates more particularly to an attachment for regulators or other clocks for closing at a given or predetermined time an electric circuit in which are interposed the magnets for regulating or setting other timepieces to agree with the regulator or clock provided with my attachment; and the invention has for its object certain features of novelty, as hereinafter fully described, and particularly pointed out in the claims.

Referring now to the accompanying drawings, Figure I is a sectional plan of the works of a regulator or clock, all parts not necessary for the explanation and an understanding of the invention being omitted. Fig. II is a vertical section taken on the line II II, Fig. I. Fig. III is a similar view, but showing the parts in the position they assume at a later period. Fig. IV is a longitudinal section taken through the minutes and hours arbors. Fig. V is a detail perspective view of the cams and levers, as hereinafter described. Fig. VI is a diagrammatic view showing the circuits and the making and breaking devices. Fig. VII is a view similar to Fig. I, but of a modification. Fig. VIII is a detail taken from the device shown in Fig. VII, as hereinafter described. Fig. IX is a diagrammatic front view showing the relation that the various cams, levers, &c., bear to one another and to the hours, minutes, and sweep-seconds hands.

1 2 are respectively the front and back plates of the movement, to the outer face of the former of which plates is secured a hollow shaft 3 by means of the foot or flange 4. (See Fig. IV.) Sleeved upon this shaft is the minutes-arbor 5, having at its inner end a cam-disk 6, which is preferably made integral or otherwise secured to said minutes-arbor and held in frictional connection with the minutes-wheel 7 by means of a blade or flat spring 8, interposed between said disk and wheel, and upon or over this minutes-arbor 5 is mounted or sleeved the hours-arbor 9 in the usual manner, having at its extreme inner extremity the large hours-wheel 10 for the purpose well understood, and secured in front of this wheel upon the arbor 9 is a second cam-disk 11, which, as clearly shown, is concentric with the aforesaid cam 6 on the minutes-arbor.

Journaled in the plates 1 and 2 is the shaft 12, which, by means of its small pinion 13^a on its outer end, imparts the desired motion to the minutes-wheel 7, with which it meshes, and mounted securely upon this shaft 12 is a third cam-disk 13. Slightly above the shaft 12 and to one side is journaled a rock-shaft 14, which extends through the front plate 1, and has at 15 a shoulder for preventing its slipping out of place. This shaft has mounted upon it two levers or arms, one 16 of which is located between the plates 1 2, while the other 17 is on the outer end of the shaft. These arms 16 17 are preferably secured to the shaft by means of frictional joints only, so that they may readily be adjusted relatively to one another, and at the same time they will hold their relative positions with sufficient rigidity for all intents and purposes. The arm or lever 16 has at its free end a transverse pin 18, adapted to rest upon the periphery of the cam-disk 13, while the arm or lever 17 has at 19 an offset, which brings its free end in front of the hours-wheel 10, in order that a transverse lug or pin 20 in its lower end may rest upon the disk 11 of the hours-arbor, and also in order that a supplemental arm or lever 21, secured by pin 22 and screw 23 to the back of lever 17, may project between the wheels 7 10 and rest its downwardly-curved point or end upon the cam-disk 6 on the minutes-arbor.

The pinion 24, on a shaft directly under the shaft 12, derives its motion from the gear of the winding-drum, (or mainspring-wheel, as the case may be, neither of which have I shown, for the sake of clearness,) and this pinion 24 drives the gear-wheel 25, which is on the same shaft with said pinion. From the wheel 25 the shaft 12 derives its motion by means of its pinion 26. Extending through the hollow shaft or pintle 3 is the sweep-seconds arbor or shaft 27, which is prevented

against end shake by means of the screw-cap 28, engaging in the hollow shaft or pintle 3 in the usual manner, and mounted upon this shaft 27 is the escape-wheel 29, with which the pallet engages, the latter, however, being omitted for the sake of clearness. The seconds-hand (not shown) is of course journaled on the outer end 32 of the arbor 27 in the usual manner. Upon the shaft 12 is also mounted the large gear-wheel 30, which engages with a pinion 31 on the shaft 27, and thus completes the gearing between the seconds-arbor 27 and the spring or drum-wheel. (Not shown.)

Now, it will of course be understood that the cam-disk 11, being on the hours-arbor, will revolve once in twelve hours, and the cam 6, being upon the minutes-arbor, will revolve twelve times as fast, or once every hour, while the shaft 12, that drives the minute-wheel 7 and carries the cam 13, has its gearing so proportioned as to revolve the cam 13 six times as fast as the minutes-wheel 7, or once every ten minutes, and the gears 30 and 31 are so proportioned as to cause the shaft 27 to revolve ten times as fast as the shaft 12, or once every minute. It will be observed that the disk 11 has a peripheral notch 33, whose side, which meets the pin 20 first, is straight, while its opposite side is slightly rounded, in order to avoid the pin catching as it rises from the notch, and the bottom of the notch is elongated and concentric with the center, for a purpose presently to be described. The cam-disk 6 has a notch 34, and its advance side, or the side which meets the point of the lever 21 first, is, like the notch 33, precipitous; but its other side is gradually rounded off from the bottom of the opposite side, in the manner plainly shown in Fig. V. The cam may continue to revolve without being obstructed by the downwardly-curved end of the lever 21, which latter is obliged to rest upon the cam, instead of, like the other levers, having a pin for this purpose, plainly for the reason that there is not sufficient space between the wheels 7 and 10 to permit a transverse pin to be employed. The cam-disk 13 is provided with a notch whose bottom is concentric with the center, and whose forward edge 35 is gradually inclined or non-diametric, in order that the pin 18 when supporting the levers upon this disk or cam 13 will slide gradually down this incline into the notch without producing the least jar, which would be exceedingly detrimental to the perfect operation of a delicate time-piece. The other edge 36 of this notch is rounded off gradually to the periphery of the disk, in order that the pin 18 may be borne upwardly to its normal position with the least possible friction. It will now be observed that it will be necessary, before the ends of the levers 16 17 21 can fall, for all of the notches in the cams 6, 11, and 13 to coincide, or at least for such notches to be under the ends of all the levers at the same time. This action may be caused to take place at any desired predetermined time; but it is customary to set clocks at noon, and for the sake of illustration I will assume that these notches have been so set that each will be under its respective lever at twelve o'clock. When the disk 11 on the hours-arbor is turned with its notch upward, as shown in Fig. V, the levers are no longer dependent upon it, but depend upon the disk 6 on the minutes-arbor, and likewise when the straight edge of the notch 34 in the disk 6 reaches the end of its lever 21 the levers no longer depend upon this disk for support, but entirely upon the ten-minutes disk 13; but these other disks are so disposed relatively to one another that the notch in the disk 13 will be almost under the pin 18 in the lever 16, as shown, by the time the notch 34 reaches the end of the lever 21, so that it will be about a minute after the second disk 6 has turned into place before the disk 13 will turn sufficiently to allow the pin 18 to slide down the incline 35 into the notch, and consequently allow all of the levers to descend into their respective notches.

It is of course understood that it takes a current of electricity longer to produce the desired effect in a circuit where there are high resistances—such as heavily-coiled electro-magnets or the like—than it does in a circuit free of such obstructions, and upon the same principle it is also understood that a primary circuit is not as strong the instant it is closed as it is an instant afterward. In other words, it would seem that it needs to get started before the battery gives off its full strength into the wire. This of course is almost indeterminable, and for many purposes is of no practical consequence or importance; but for my purpose, where I desire to set a number of clocks to agree with a single regulator, and that, too, within the fractional part of a second, it is of the utmost importance that the electro-magnets in the circuit for setting these secondary clocks should respond the instant the regulator closes the circuit. This of course I can only accomplish in a measure; but I reduce the fault to a minimum by employing, virtually, two circuits, and I also by this arrangement avoid the damaging spark that commonly occurs when a contact is broken. The first of these circuits (see Fig. VI) I shall term the "primary circuit," in which the battery 36 is located, and it is designated by the signs 37 38, the terminal 37 being secured to the plate 39, carrying the adjustable screw or contact-point 40, and the other terminal 38 being connected to the switch 41, which latter is adapted to impinge the under side of a spring-contact 42, while the latter rests normally upon the contact 40, and thus completes the circuit. All of these parts are mounted upon an insulating-block 43, secured to the front plate of the clock. The other or secondary circuit has in it the magnets 44 for regulating or setting the secondary clocks, and its terminal 45 is connected to the spring-contact 42, while its

other terminal 46 is connected to the plate 39. Thus it will be seen that when the switch 41 is elevated into the position shown in Fig. 6 the primary circuit will be closed and the secondary circuit will also be closed; but it will be short-circuited by the primary circuit, and consequently no current will pass through the magnets while such is the condition of the circuits; but should the spring 42 be lifted from the contact 40 the short circuit would be broken and the current would pass through the magnets 44 and operate their armatures. Therefore, as before mentioned, I get the battery started or working at its full power by completing the short or primary circuit 37 38, and then at the desired instant the short circuit is broken, which, so to speak, causes the already-started current to flow with full force through the magnets. I bring about this action as follows: Projecting from the lever or arm 16 is a pin or lug 46^a, which, when the cam 13 allows said levers to descend, bears upon a tail 47 of the switch 41, the said tail being bent to one side in order to accommodate the said pin, and the switch being provided with an elongated journal 48 and bearing on screw 49 to insure against unsteadiness of the switch 41. The weight of the levers 16 17 21 thus raises the switch 41 from the position shown in Fig. II to the position shown in full lines in Fig. III, with its point very near the under side of the spring 42, but not touching it, the weight of the levers being sufficient to bear the switch 41 upward, but such levers being prevented from raising the switch into contact with the spring 42 by reason of the point of the arm 21 resting against the periphery of its disk or cam 6. The cams may be so set relative to one another as to cause such action to take place several seconds before the time for setting the secondary clocks, and at this predetermined time an arm or lever 50, mounted on the seconds arbor or shaft 27, is turned to a substantially vertical position, and by means of a projecting pin or lug 51 strikes under a bevel or cam faced pin 52, projecting from the switch 41, and raises such switch still higher, forcing the point of the switch into contact with the spring 42, which closes the primary circuit; but the cam-face of the pin 52, being not as yet passed the switch, will continue to rise, and in so doing will force the spring 42 from its contact with the point 40, thus breaking the short circuit and throwing the full circuit into the secondary circuit, but allows it to pass therein only for an instant or a small fractional part of a second, which is owing to the fact that the cam-face of the pin 52 is shorter than the distance traveled by the pin 51 during the period of one second. A slight motion of the pin 51 will now bring it past the cam-face of the pin 52, and disengaging the latter will of course allow the switch 41 to descend to its former position, with the tail 47 resting under lug 46^a, the primary circuit of course being broken by this action. The induced current caused by breaking the circuit does not, however, produce the usual detrimental spark at the point of the switch 41 when it leaves the spring 42, as such current finds a closed way *via* the spring 42, contact 40, plate 39, and terminal 37, back into the battery. The lever or arm 50 is provided at one end with a counter-balance 53, and at its outer with a slot 54, in which the pin 51 is adjustably secured. (See Fig. V.) The disk 13 supports the three levers until the cam or disk 6 has turned sufficiently far to support them by the lever or arm 21, and by the time the notch 34 in this disk comes around again the disk 11 will be turned sufficiently far to support the levers for the next twelve hours.

In the mechanism which I have described it is apparent that the levers 16 and 17 must be so adjusted on shaft 14 relatively to one another that the inner arm or lever 21 will come in contact with the bottom of the notch 34 in the disk 6 before the pin or lug 18 on the lever 16 has reached the bottom of the notch in the disk 13, thus avoiding the friction that this lug or pin 18 would produce on the disk, and at the same time preventing the pin or lug 46 from descending too far, or, in other words, allowing it to descend far enough to bring the point of the switch 41 within but a short distance of the contact 42; but, if it should be desired, these levers may be so adjusted on the shaft 14 as to allow the lug or pin 46 to descend sufficiently far to raise the point of the switch 41 into contact with the spring or contact 42, and in this event the arm 50 would have nought to do but raise the spring 42 from its contact 40. Inasmuch as when the hands are moved for setting the clock the disk 13 remains stationary or only revolves at its usual speed, it is readily seen that the proper relative positions of the cams may be thus destroyed; but in view of the fact that the edge 35 of the notch in the disk or cam 13 meets the pin 18 every ten minutes, this destruction of the proper relations of the cams may be avoided by setting the clock when the minute-hand is at any number of minutes from twelve (in this case) on the dial, of which ten is a common divisor. This must be done, because otherwise the position of the cam 13 would not be known, the positions of the other two cams being indicated by or being the same as that of the hands. A way of avoiding this derangement, however, of the cams is illustrated in Figs. VII and VIII. In this form it is my object to so arrange the cam-disk 13 as to cause it to revolve with the minutes-arbor 5 when the latter is turned by its hand in setting the regulator. In order to do this I secure the said cam 13 and the pinion 13^a together and mount them as idlers on the outer end of the shaft 12. In order, however, that the pinion may perform its proper function—*i. e.*, impart motion from the shaft 12 to the minutes-wheel 7—I mount these two parts

13 13ª upon the shaft 12 with sufficient frictional contact therewith to cause them to revolve with such shaft in any well-known manner—such, for instance, as shown—which consists in providing the shaft 12 with a shoulder 54 and a nut or abutment 55, between which two latter the disk 13 and pinion 13ª are mounted and held with sufficient friction against the abutment 55 by means of a flat spring 56. As it requires but very little power on the wheel 7 to drive the hands, it will be seen that the spring 56 will offer enough friction between the shaft 12 and pinion 13ª to drive the hands during the usual running of the regulator; but when the hands are turned in setting them the shaft 12 will not be able to increase its rate of speed, and consequently the pinion 13ª must turn on the shaft, carrying with it the cam 13, which of course will thereby prevent the latter from losing its position relative to the cams 6 and 11, and the latter are compelled to retain their proper relative positions by reason of the fact that each is made fast to its arbor, and the pinion 57 is also made fast with the minutes-arbor. The usual wheel 58 and pinion 59 of course engage this pinion 57 and hours-wheel 10, respectively. When this form is used, the lever 16 need be of sufficient length only to reach the tail 47 of the switch 41 with the pin 46, and the arm or lever 21 may be provided with a transverse downwardly-projecting pin or arm 60, which rests upon the cam 13 and performs identically the same functions as the pin or lug 18.

In this application I have shown my invention as applied to but one of the well-known forms of a "sweep seconds regulator;" but it will of course be understood that other forms of regulators may be provided with my attachment without departing from the spirit of the invention.

I further desire it to be understood that I do not limit my invention to the use herein particularly described, as it is very obvious that it may be employed for closing circuits at certain times for other purposes.

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

1. The combination, with a flexible contact for closing the secondary circuit, a switch adapted to close the primary circuit through the medium of said contact, and a pin projecting laterally from said switch, of the seconds-arbor, an arm on said arbor, and a pin on said arm adapted to strike the pin on said switch and operate the latter, substantially as specified.

2. The combination, with a flexible contact for closing the secondary circuit, a switch adapted to close the primary circuit through the medium of said contact, and the seconds-arbor, of an arm on said arbor, a pin on said arm, and a pin on said switch projecting therefrom parallel with the pin on said arm and adapted to be struck by the pin on said arm for operating said switch, substantially as specified.

3. The combination, with the seconds-arbor and a switch for closing an electric circuit, of a lever on said arbor, a pin projecting from said lever, and a pin projecting from said switch parallel with the pin on said lever, and having a bevel or cam face turned toward and adapted to be struck by the pin on said lever, substantially as specified.

4. The combination, with the minutes and hours arbors, an electric switch having the tail 47, and the seconds-arbor, of cams revolving in unison with the minutes and hours arbors, a beveled pin 52, projecting from said switch, a lever on said seconds-arbor carrying a pin 51, levers resting against said cams and having operative connection with the tail of said switch, whereby the movement of said cams will place the pin 52 in the path of the pin 51, substantially as and for the purpose set forth.

5. The combination, with the electric switch, the pin 52 on said switch, and the minutes and the hours arbors, of cams on said arbors, levers resting against said cams and adapted to partially close said switch, the seconds-arbor, an arm connected to and revolved by said seconds-arbor, and a pin projecting from said arm and adapted to strike pin 52 and completely close said switch, substantially as set forth.

6. In a clock, the combination, with an electric switch and the minutes and the hours arbors, of disks having irregularities on said arbors, levers resting against said disks and adapted to partially close said switch when said irregularities meet said levers, the seconds-arbor, and an arm connected to and revolved by said seconds-arbor and arranged to force said switch completely closed, substantially as set forth.

7. In a clock, the combination, with the electric switch having the pin 52, of two or more revoluble cam-disks, levers resting against said disks and adapted to partially close said switch, a revoluble arm, and the pin 51 on said arm adapted to strike the pin 52 and wholly close said switch, substantially as set forth.

8. The combination, with the flexible contact for closing the secondary circuit, and a switch for closing the primary circuit having the pin 52, a revoluble arm carrying the pin 51, a number of revoluble disks having irregularities, levers resting against said disks and adapted to raise said switch with pin 52 in the path of pin 51 when such irregularities meet said levers, whereby pin 51 will strike pin 52, and thus close the primary circuit and raise said flexible contact, substantially as set forth.

9. The combination, with the normally-closed contact 42 of a secondary circuit, and a switch adapted to close a primary circuit through said contact, of a number of revoluble disks having irregularities, levers rest-

ing upon said disks and adapted to partially close said switch when such irregularities meet said levers, and a revoluble arm arranged to force said switch against contact 42, whereby the primary circuit is closed and the said contact raised, substantially as and for the purpose set forth.

10. In a clock, the combination, with the normally-closed contact 42 of a secondary circuit, and a switch for closing a primary circuit through said contact, of a beveled pin 52, projecting from said switch, a revoluble arm, a pin 51, projecting from said arm, a number of revoluble disks having irregularities, levers resting against said disks and adapted to move said switch toward the contact 42, and with its pin 52 in the path of the pin 51, whereby when the latter strikes the pin 52 the switch will contact with and break the contact 42, as set forth.

11. The combination, with the secondary circuit, the contact 40, the flexible contact 42, resting thereon and closing said circuit, the primary circuit and a switch for closing said primary circuit, through said contacts 40 and 42, of a beveled pin 52, projecting from said switch, the seconds-arbor and arm having a pin 51 on said seconds-arbor, the hours and minutes arbors, the shaft 12, cams on said arbors and shaft, and a number of levers resting against said cams and having operative connection with said switch, substantially as set forth.

12. The combination, with the secondary circuit, the contact 40, the flexible contact 42, resting thereon and closing said circuit, the primary circuit, and a switch for closing said primary circuit through contacts 40 and 42, of a pin 50, projecting from said switch, the hours and minutes arbors, the shaft 12, cams on said arbors and shaft, the shaft 14, a number of levers or arms on said shaft supported by said cams, the extension or tail 47 of the switch adapted to be depressed by one of said arms or levers, and thus oscillate the switch, the seconds-arbor, arm 50 on said seconds-arbor having pin 51, adapted to strike pin 52 when the tail 47 is depressed, and thus raise contact 42 from contact 40, as set forth.

HENRY C. KARR.

Witnesses:
OCTAVIUS KNIGHT,
F. A. HOPKINS.