(No Model.) 2 Sheets—Sheet 1.

J. E. CAREY.

ELECTRIC CLOCK MOVEMENT.

No. 316,112. Patented Apr. 21, 1885.

Fig: 1.

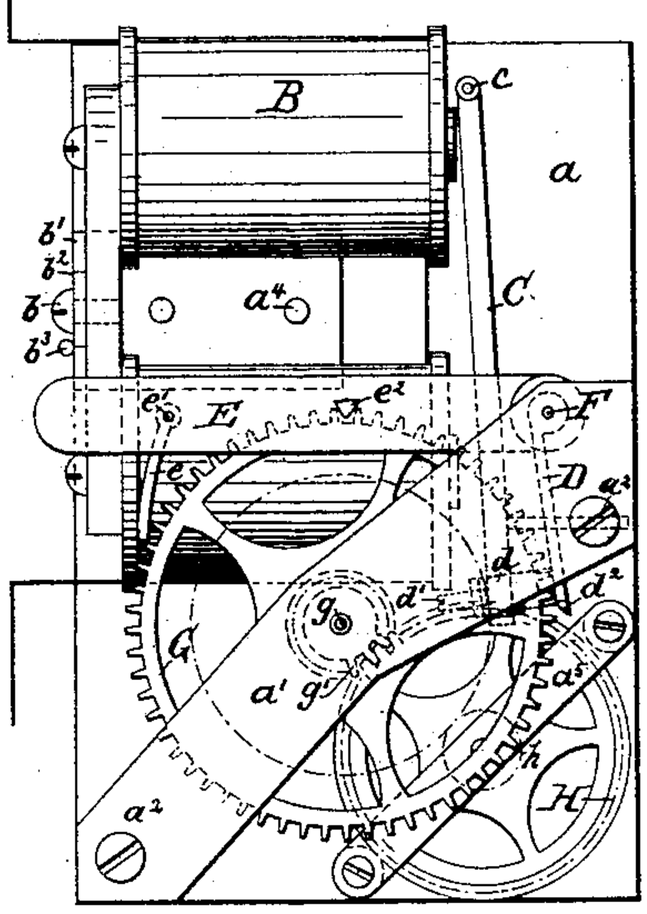


Fig: 2.

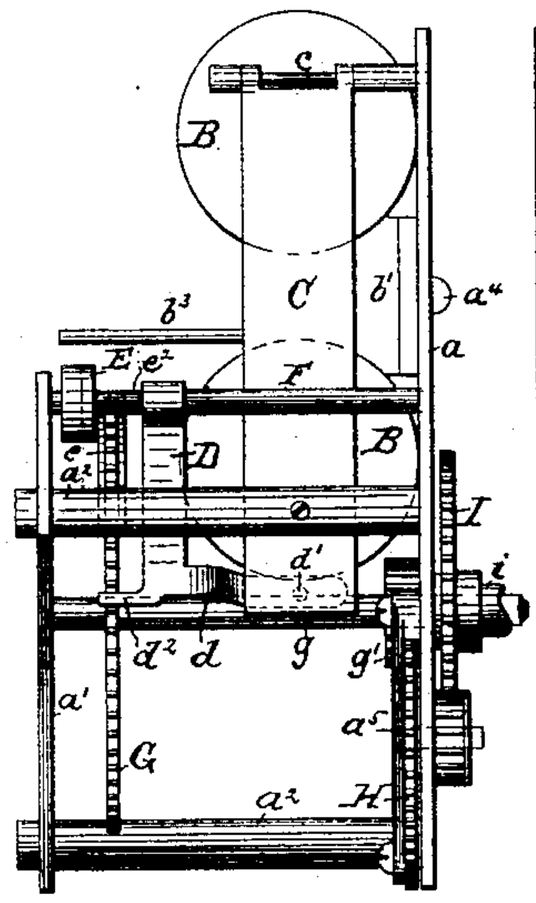


Fig: 3.

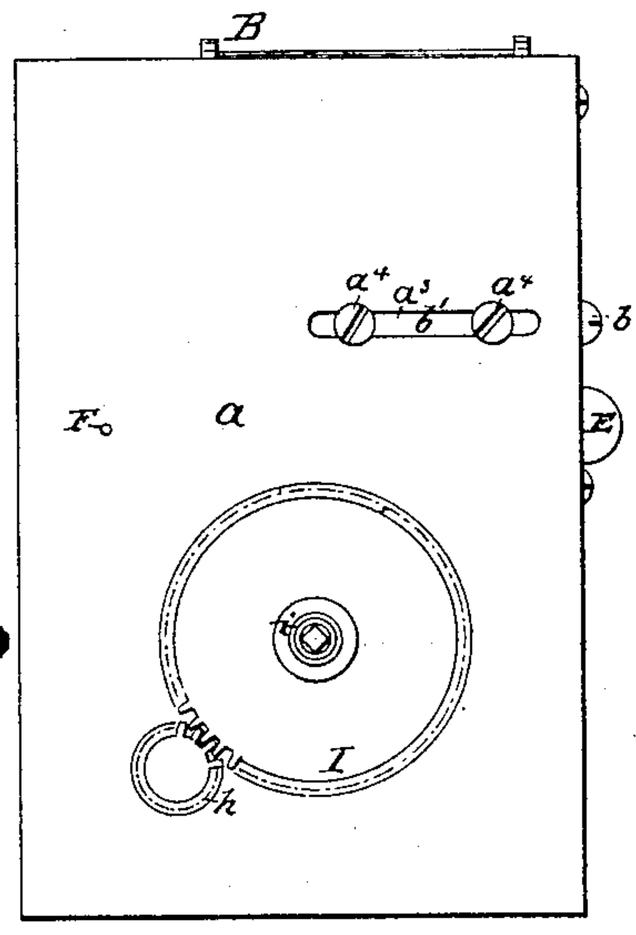


Fig: 4.

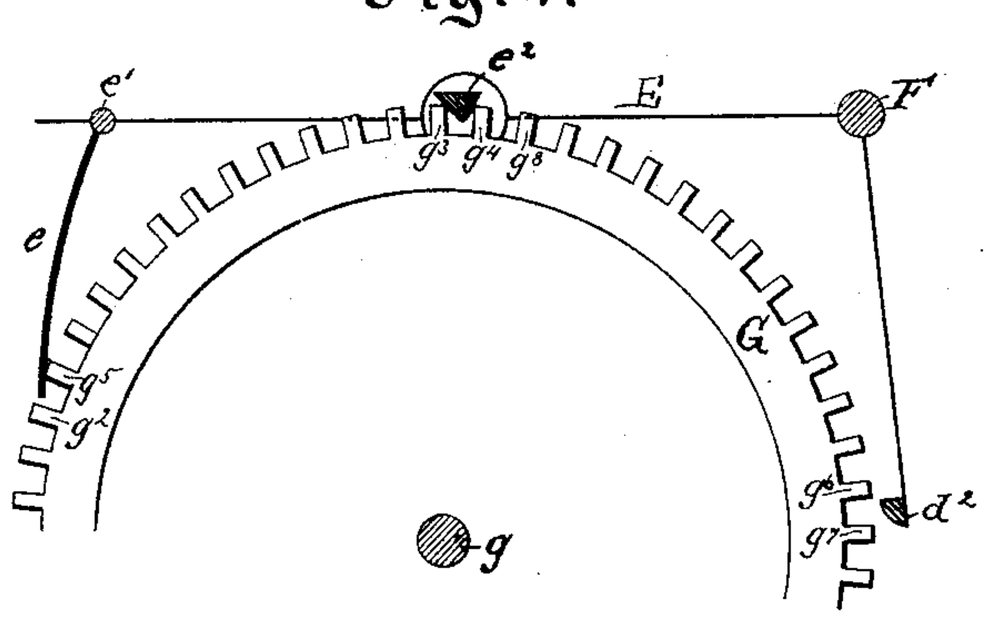
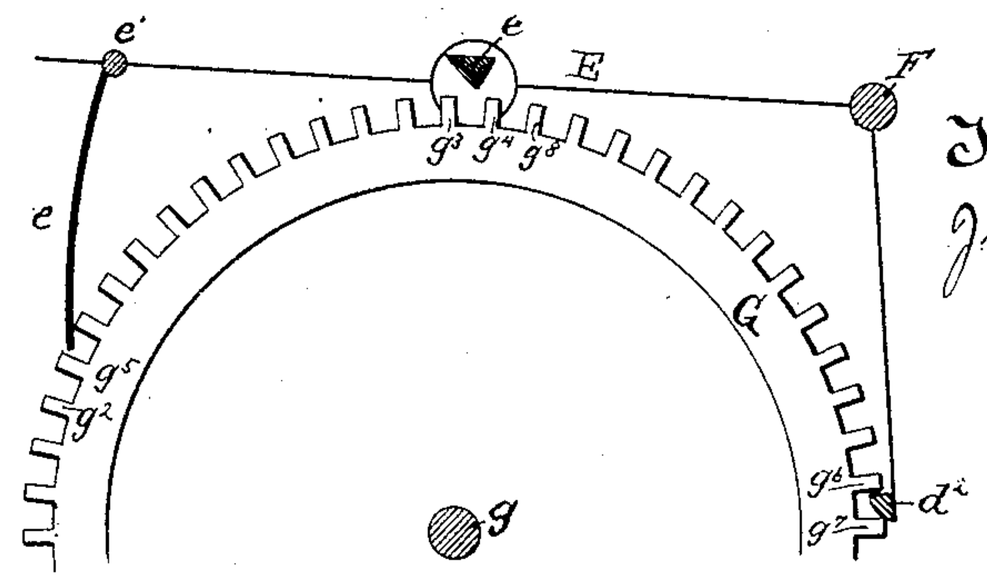


Fig: 5.



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(No Model.) 2 Sheets—Sheet 2.

J. E. CAREY.

ELECTRIC CLOCK MOVEMENT.

No. 316,112. Patented Apr. 21, 1885.

Fig: 6

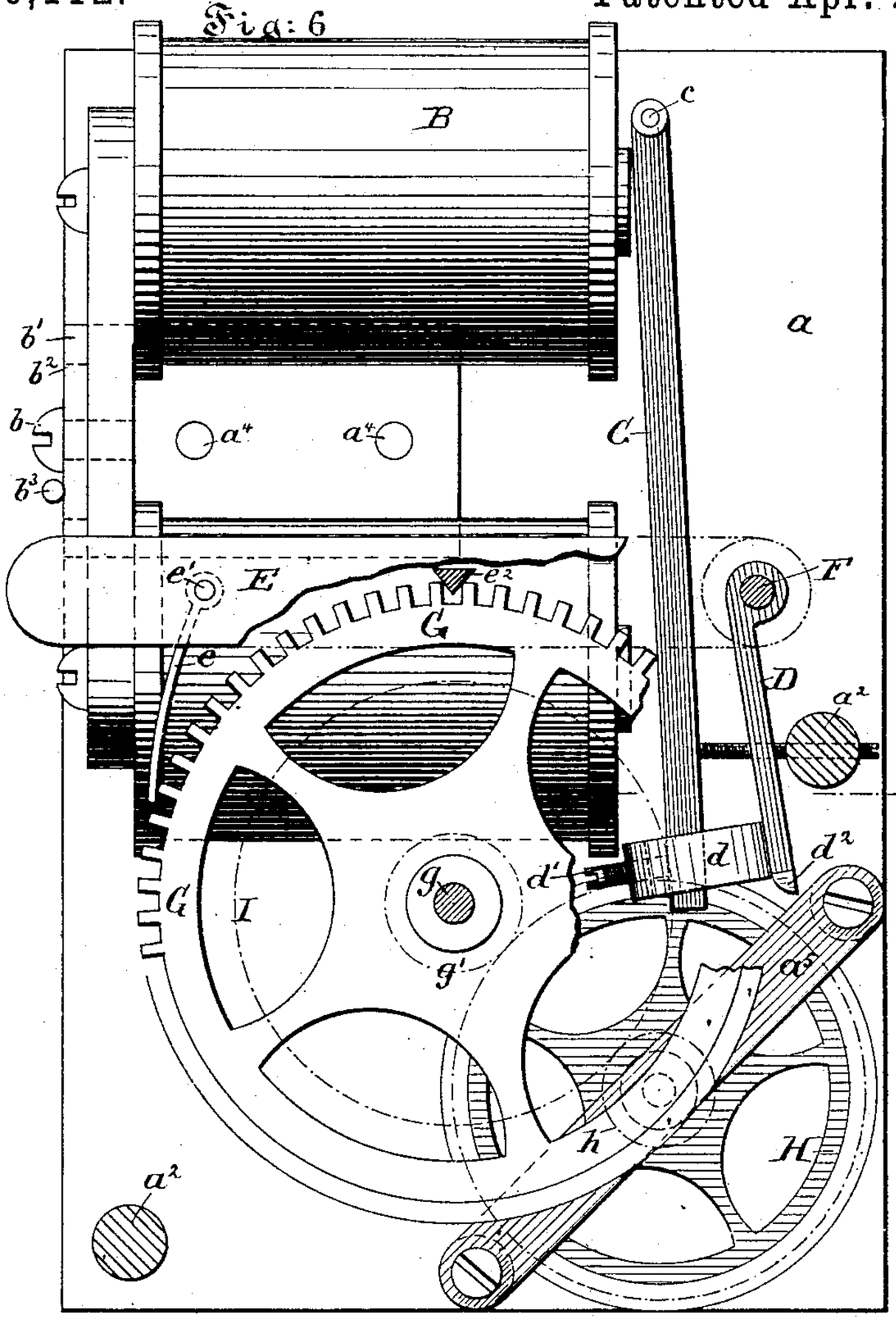
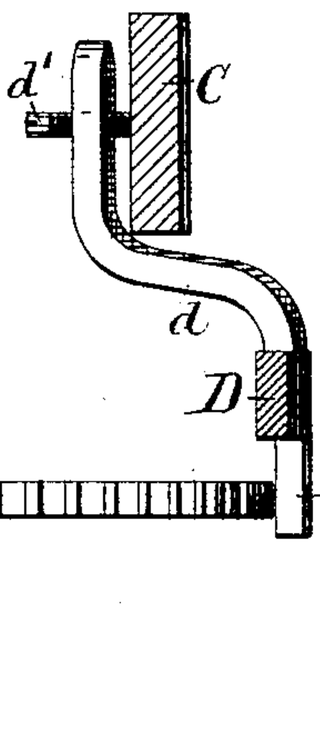


Fig: 7.



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UNITED STATES PATENT OFFICE.

JULIAN E. CAREY, OF NEW YORK, N. Y.

ELECTRIC-CLOCK MOVEMENT.

SPECIFICATION forming part of Letters Patent No. 316,112, dated April 21, 1885.

Application filed March 8, 1884. (No model.)

To all whom it may concern:

Be it known that I, JULIAN E. CAREY, of the city, county, and State of New York, have invented certain new and useful Improvements in Electric-Clock Movements; and I do hereby declare that the following is a full and exact description thereof.

The objects of my invention are to produce a movement for electric clocks which shall be sufficiently simple and cheap to allow its introduction into general use, and which shall be so constructed as to preclude the possibility of occasional failure either in consequence of the improper reception of the electric impulses or of parts of the mechanism getting out of order.

I am aware that electric-clock movements are in existence which operate satisfactorily; but such movements are of complicated construction, and for this reason alone very expensive, while, in order to insure a continuous good service, the delicate parts of such movements require frequent inspection. I have ascertained by repeated and prolonged experiments that with my invention these difficulties are overcome, since the peculiar arrangement of parts insures an efficient and reliable service without necessitating frequent examinations of the apparatus, the simplicity of the latter at the same time permitting it to be offered at such prices as will greatly advance the general use of the electric time system.

In order to insure against accidental turning of the hand-moving mechanism, I have devised a combination of stops arranged to engage with the wheel which is driven by the action of the armature, so that the said wheel is at no time free to turn in either direction, except when the propelling-pawl is brought into position for action, and then the motion of the parts which cause said pawl to act is such that the wheel can turn only the required distance in the desired direction, becoming again locked by the very termination of such motion. I am aware that this effect has partly been produced prior to my invention by the employment of a retaining-pawl or of analogous devices; but all such devices have required the employment of an extra pivot, and also in many cases the action of springs, whereby the construction was made expensive and the apparatus more delicate. The stops used by me for this purpose, while more efficient, may be made very cheap, either by stamping up the metal or otherwise, particularly when manufactured in large quantities.

Certain minor details of the invention not particularly mentioned here, but claimed, will be fully described in the following.

The accompanying drawings form a part of this specification, and represent what I consider the best means of carrying out the invention.

Figure 1 is a back view of the movement. Fig. 2 is a side view of the same. Fig. 3 is a front view. Figs. 4 and 5 are diagrams, the former showing the wheel moving and retaining parts and their relation to the wheel in the position of rest, and the latter showing the same parts after they have been lifted to move the wheel one step. Fig. 6 is a view on a larger scale, corresponding to Fig. 1, certain portions being broken away. Fig. 7 is a plan in section on the line x x, Fig. 6, showing certain portions of the mechanism.

The frame of the mechanism is composed of the front plate, a, smaller back plate, a', and posts a^2 a^2. The electro-magnet B, which receives the electric impulses at given intervals from a suitable source, (not represented,) is mounted by means of a screw, b, upon an angle-plate, b', the hole in the latter, through which the screw b passes being formed as a slot, as shown at b^2, Figs. 1 and 6, so as to allow the magnet to be adjusted vertically. The lateral adjustment of the magnet with relation to its armature C is effected by means of a slot, a^3, through which pass the screws a^4, which fasten to the plate b' to the main plate a.

It will be seen that a peculiar advantage is gained by this adjustment of the magnet B, which permits the locating and securing of the magnet in a vertical line, after a lateral adjustment has been fixed, without in any way disturbing it; and the reverse is also true, that when a vertical adjustment has been determined and fixed a lateral adjustment may afterward be made without in the slightest affecting the vertical adjustment already made. This arangement allows the armature to be at once fixed permanently with relation to the parts operated by it, and requires no further displacement. The armature C is supported at the center c, and it is normally held away from

the poles of electro-magnet B by the overbalancing weight of the parts that it acts upon when energized. The latter parts consist of a bell-crank lever, the arms thereof being lettered D and E. These arms are fastened upon the shaft F, so that both are compelled to move together.

The arm D consists of a substantially downward-projecting part the lower extremity of which is formed on one side with an arm, d, the latter being bent so as to reach behind that side of the armature C which faces the poles of the electro-magnet, where it carries an adjusting-screw, d', which bears against the said face of armature C. On the opposite side the extremity of the arm D carries one, d^2, of the above-mentioned stops, the latter reaching across the periphery of the minute-wheel G. The arm E carries near its extremity the pawl e, pivoted at e' and arranged so as to be able to co-operate with the teeth of the wheel G. About midway between the center of the axis F and the pin e' is arranged the other, e^2, of the above-mentioned stops. b^3 is a safety-stop attached to the plate b' or to any other part of the fixed frame. This stop serves to prevent the arm E from ever rising too high in case of accidental derangement of any of the other parts of the mechanism. The wheel G has sixty teeth, and is fastened upon the shaft g, which carries the minute-hand. (Not represented.) A pinion, g', upon the shaft g engages with a wheel, H, the pivot of which is firmly set in the bridge piece a^5. A second pinion, h, fastened to the wheel H, extends through the plate a and engages on the front thereof with the wheel I upon the sleeve i. The train g' H h I is the ordinary train for transmitting the proper motion from the minute-shaft to the hour-hand, and does not, therefore, require any further detailed description.

The general operation of the mechanism is very simple and requires only a few words to be fully understand, upon which the effect of the stops d^2 e^2 in the co-operation with the wheel G will be fully and minutely set forth.

It is evident that when the armature C is attracted by the energizing of the magnet B the arm D, by means of its extension d, and consequently the axis F and arms E, will be rocked so as to raise the arm E, with its pawl e, the latter engaging with the tooth following the one that it was engaged with at the preceding moment. When the armature is then released, the weight of the lever E will cause a rocking of the system upon the axis F in the opposite direction. Thereby the wheel G is turned one step, moving both hands through the proper connections, as desired.

Considering, now, Figs. 4 and 5, it will be noticed that with the mechanism at rest, as in Fig. 4, the stop d' is out of engagement, the pawl e appears as not resting upon the upper side of the tooth g^2, which it was engaged with at the preceding operation, and the two sides of the triangular stop e^2 are engaged between the teeth g^3 g^4 in such manner that either tooth is in firm contact (due to the weight of the arm E) with a side of the stop e^2. Thus conditioned the latter prevents the wheel G from being turned by any force that, under ordinary circumstances, might be brought to act on it accidentally. If, now, the bell-crank lever D E on shaft F begins a rocking motion, the pawl e will rise over the tooth g^5, and the stop e^2 gradually leaves the space between the teeth g^3 g^4; but before it has left said space completely, whereby the wheel G would become liberated, the stop d^2 enters between the teeth g^6 g^7 and in its turn locks the wheel G. On the succeeding downward motion, now, of the parts, the top d^2 begins immediately to recede from between the teeth g^6 g^7, so that, upon the pawl e coming in contact with the tooth g^5, it can begin to turn the wheel, the inclined lower side of stop d^2 permitting such motion, said stop receding gradually, as required, by the forward motion of the wheel, while an accidental return motion of the wheel would still be prevented by the upper face of stop d^2 coming in contact with the lower side of tooth g^6 until the stop has completely left the space between teeth g^6 g^7, but at that moment the tooth g^4 has already passed under the point of stop e^2, and the latter has entered the space between teeth g^4 and g^8, thus again in its turn controlling the wheel G. At the final part of the downward movement that inclined face of stop e^2 which comes then in contact with the edge of tooth g^4 pressing upon the latter urges the wheel G on a little faster, so as to liberate the pawl e from the face of tooth g^5, and bringing the wheel to rest in a position corresponding to that shown in Fig. 4, having advanced, of course, the distance of one tooth. It will thus be seen that the stop e^2 not only serves to hold the wheel in position after it has been moved, but it also acts as an impelling-pawl to liberate the wheel from the main pawl e and turn it sufficiently to bring it into the exact position required after each step.

In practice I find that the best results are obtained when the distances between F and e^2 and between F and d^2 are equal, and when the distance between F and e' is double the former.

Many modifications may be made in the details without departing from the principle of my invention or sacrificing all the advantages thereof.

It is not necessary that the wheel G be mounted upon the minute-hand shaft, so that an electric impulse has to be sent over the line every minute. The wheel may have any other desired number of teeth and the electric impulses sent at any desired intervals; but in this case suitable connection will have to be made, either by gearing or otherwise, with the minute-hand shaft to propel the hands properly.

In some cases I can dispense with the stop d^2, and use only the propelling-pawl e and the "setting" or adjusting pawl or stop e^2. In this manner the construction of the device

is still more simplified, while at least some of the advantages of my invention are retained.

I attach considerable importance to the fact that the armature C is suspended in a vertical or nearly vertical plane, because thereby the weight of said armature may be entirely thrown out of consideration in the construction of the device, so as to leave the weight of the parts swinging on or with the arbor F the only matter to be considered with reference to the strength of the electric current required for operation, and this weight of the parts carried by F may be easily adjusted by slightly increasing or diminishing the quantity of metal or by other well-known means.

I claim as my invention—

1. The combination, with a driven wheel, as G, of a rocking lever carrying a pawl capable of engaging with the teeth of said wheel, and two rigid stops arranged to act alternately as retaining means for the wheel, one of said stops being so shaped as to act also as an additional impelling-pawl, whereby the wheel is set or adjusted in its final position of rest after each step, substantially as specified.

2. The combination, with a driven wheel, of a rocking lever carrying a pawl and two rigid stops, one of which latter serves also as an additional impelling-pawl, and of suitable automatic means for imparting motion to said lever mechanism, all arranged to operate substantially as herein specified.

3. The combination, with magnet B, vertically-suspended armature C, driven wheel G, and rocking shaft F, of the arm D, having extensions *d* and d^2, engaging the one with the armature and the other with wheel G, and of arm E, carrying pawl *e* and stop or projection e^2, which latter two parts act both on wheel G, both arms D and E being carried by the shaft F, and the whole being arranged to operate substantially as herein specified.

4. The combination, with a driven wheel, as G, of a rocking lever carrying a pawl capable of engaging with the teeth of said wheel, and a rigid stop, as e^2, arranged to act alternately as a retaining means for the wheel and as an additional impelling-pawl, whereby the wheel is set or adjusted in its final position of rest after each step, substantially as specified.

5. The combination of a magnet, B, vertically-suspended armature C, driven wheel, as G, rock-shaft F, an arm carried on said rock-shaft, as *d*, with a gravity propelling-lever, E, arranged normally in a horizontal plane, its propelling-pawl *e* carried at its vibrating end, and a main controlling-stop carried upon said lever, substantially as described.

6. The combination of magnet B, vertical armature C, gravity-lever E, carrying pawl *e* and stop e^2, rock-shaft F, carrying lever D, with arms *d* and d^2, and wheel G, all constructed to operate substantially as described.

7. The combination of magnet B, vertically-arranged armature C, with arm *d*, rock-shaft F, and bell-crank lever D E, carrying pawl *e* and stops e^2 d^2, practically at right angles from their center of motion, for alternately engaging between the teeth of wheel G, substantially as described.

8. The combination of magnet B, vertical armature C, an arm, D *d*, mounted on shaft F, a gravity propelling-lever, E, with its propelling-pawl carried at its vibrating end, and an adjusting stop, all to operate wheel G, substantially as described.

9. The combination of an adjustable electro-magnet, an armature constructed to engage with an arm arranged upon a rock-shaft at right angles, or nearly so, with a gravity-lever which carries the propelling-pawl, and main stop for the driving-wheel, substantially as described.

10. The combination, with driven wheel G and gravity-lever E, carrying propelling-pawl *e* near its vibrating end, of a centrally-located adjusting-stop carried upon said lever, a rock-shaft, an arm, D, carrying stop d^2, and means for operating the same, substantially as described.

11. The combination of the electro-magnet B and vertical armature C, constructed to bear upon an arm carried by the rock-shaft for raising a gravity-lever upon which are mounted at its end a propelling-pawl and at its center the main controlling-stop, substantially as described.

12. The combination of the magnet B, vertically-arranged armature C, for engaging with an arm, *d*, carried by a rock-shaft, a gravity-lever carrying a propelling-pawl at its vibrating end, and a main controlling-stop with a vertical arm, D, carrying stop d^2, substantially as described.

13. The combination of an electro-magnet, and a vertically-arranged armature constructed to engage with one arm of and vibrate a bell-crank lever carried by a rock-shaft, and carrying a propelling-pawl at the end of one of its arms and a stop at the end of its other arm, substantially as described.

14. The combination, with driven wheel G and lever E, carrying propelling-pawl *e* near its vibrating end, of a centrally-located adjusting-stop carried upon said lever, a rock-shaft, an arm, D, carrying stop d^2, and means for operating the same, substantially as described.

15. The combination of electro-magnet B and armature C, constructed to bear upon an arm carried by the rock-shaft for operating a lever upon which are mounted at its end a propelling-pawl and at its center the main controlling-stop, substantially as described.

16. The combination of an electro-magnet, and an armature constructed to engage with one arm of a bell-crank lever carried by a rock-shaft and provided with a propelling-pawl at the end of one of its arms and a stop at the end of its other arm, substantially as described.

17. In an electric clock, the combination, with an armature controlling the hand-moving mechanism, of a magnet and two sets of

set-screws, whereby said magnet may be adjusted in two directions at right angles to each other, substantially as described.

18. In an electric clock, an electro-magnet and a vertically-arranged armature constructed so as to engage directly with an arm upon a rock-shaft, in combination with said rock-shaft, and with arms or levers mounted on the latter and carrying stops or pawls which operate the driven wheel, substantially as described.

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