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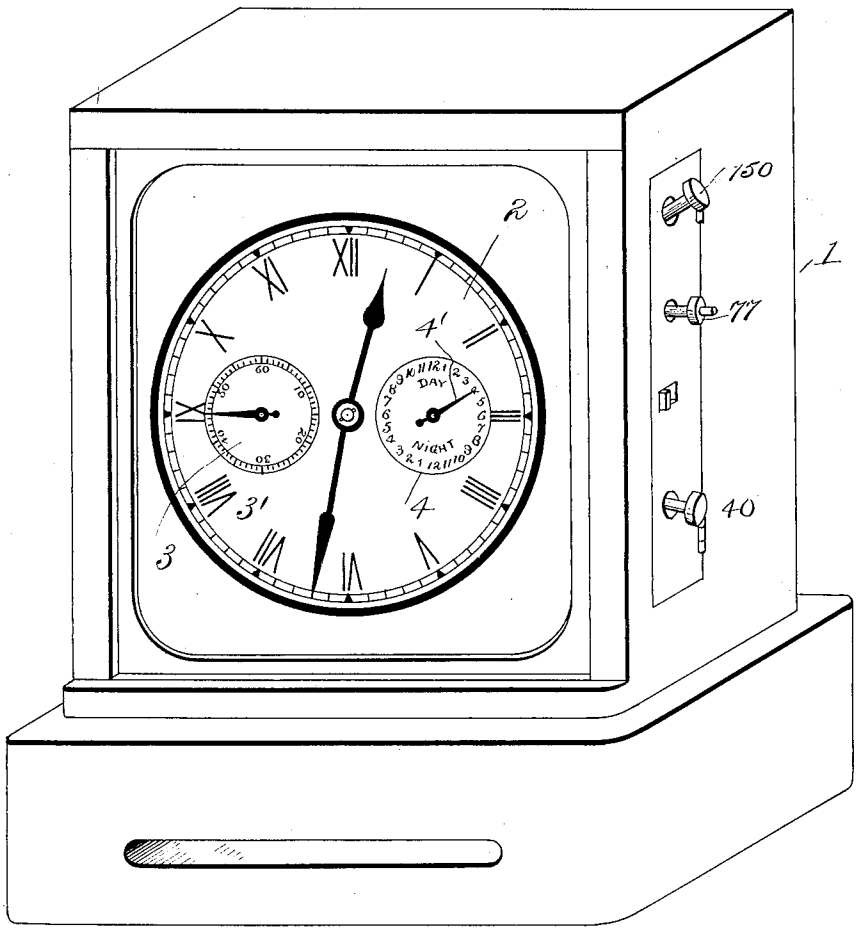
ELECTRIC CLOCK.

APPLICATION FILED NOV. 3, 1903. RENEWED MAR. 17, 1908.

**898,649.** Patented Sept. 15, 1908.

4 SHEETS—SHEET 1.

*Fig. 1.*




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4 SHEETS—SHEET 2.

Fig. 2.

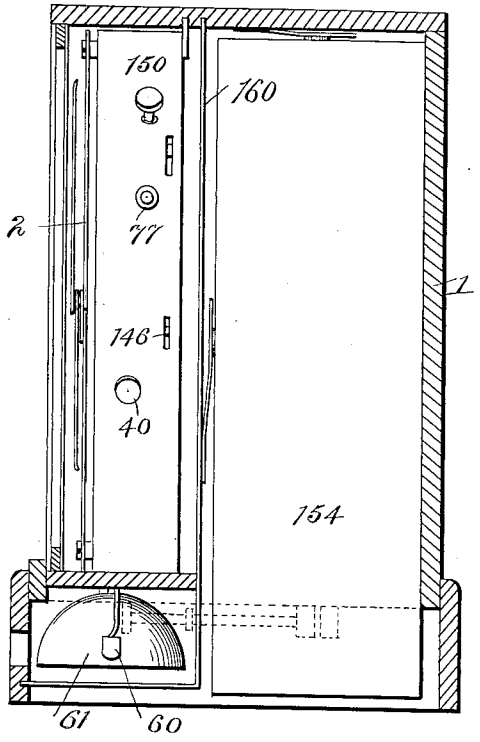
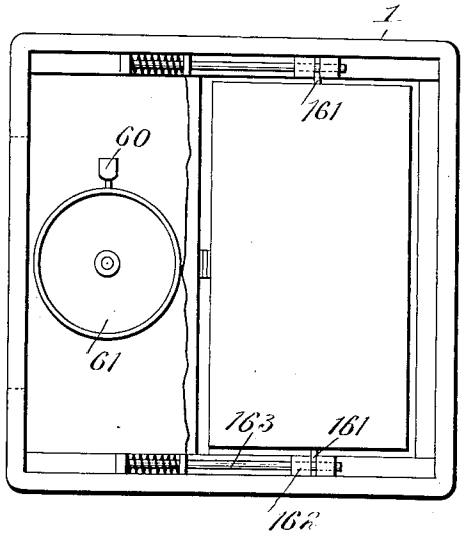



Fig. 3




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4 SHEETS—SHEET 3.

FIG. 4.

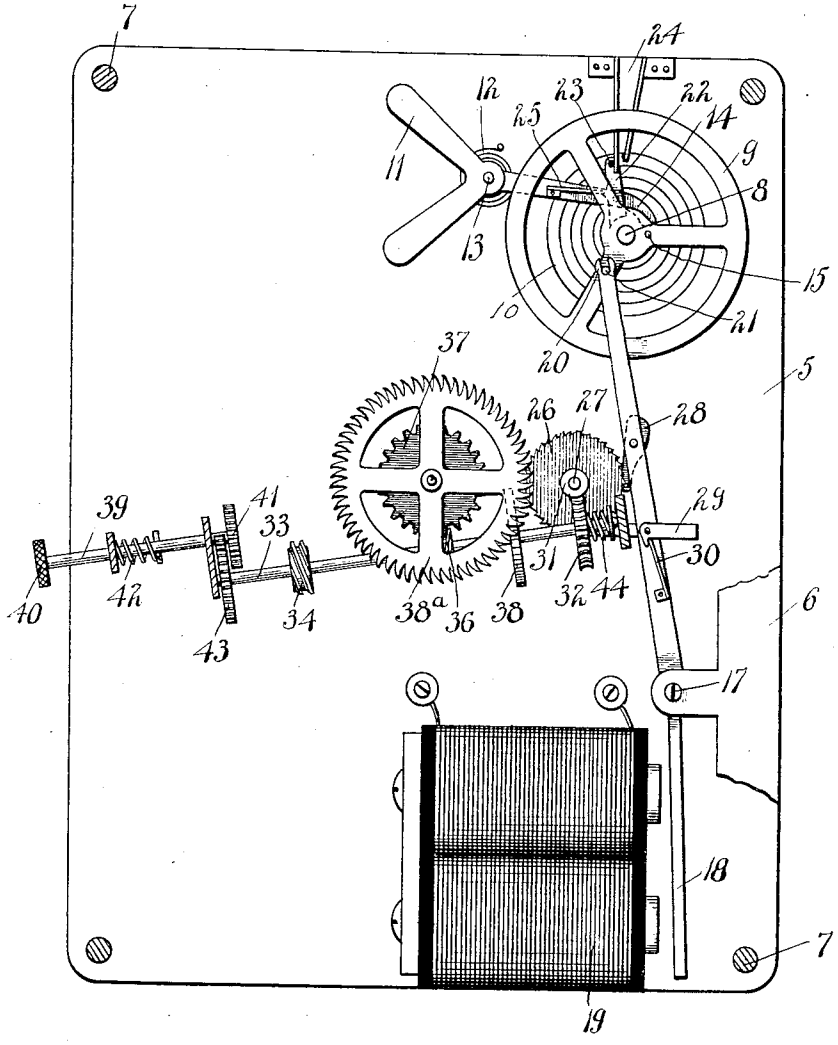
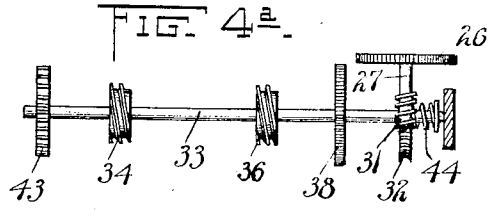



FIG. 4a.




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4 SHEETS—SHEET 4.

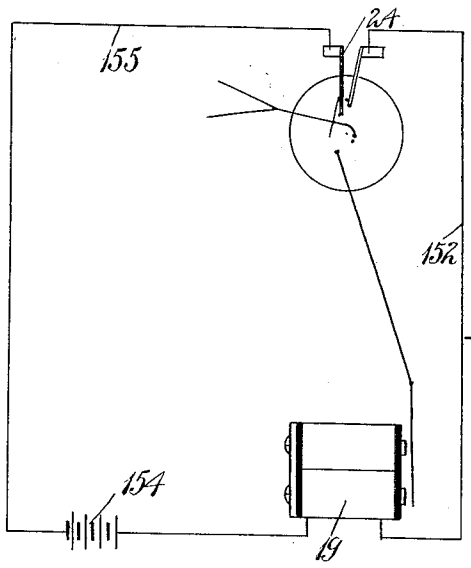



FIG. 10.

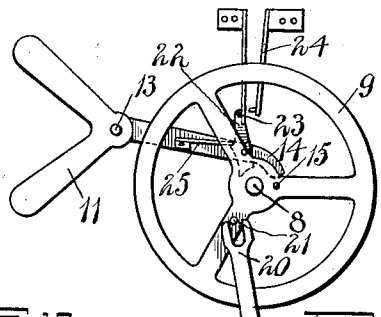
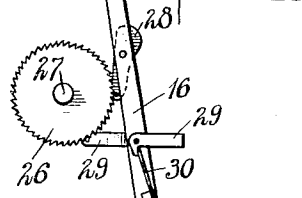



FIG. 5.



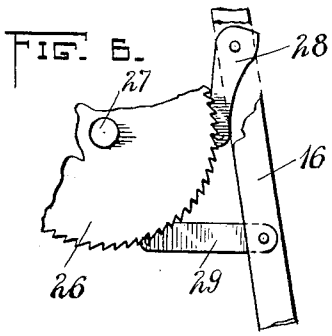
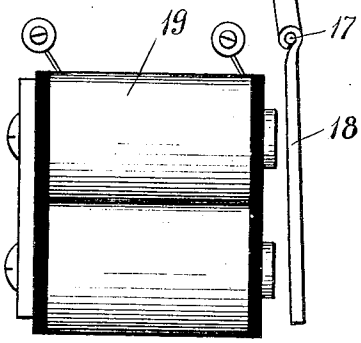




FIG. 6.



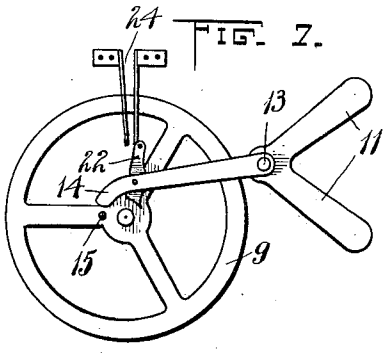




FIG. 7.

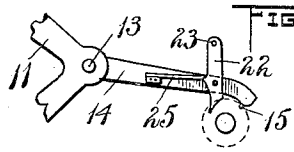



FIG. 8.

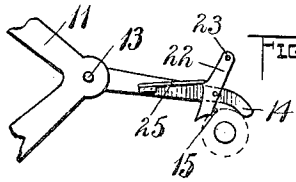



FIG. 9.

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# UNITED STATES PATENT OFFICE.

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## ELECTRIC CLOCK.

No. 898,649. Specification of Letters Patent. Patented Sept. 15, 1908.

Application filed November 3, 1903, Serial No. 179,661. Renewed March 17, 1908. Serial No. 421,709.

*To all whom it may concern:*

Be it known that I, MONNOSUKE HIGUCHI, a subject of the Emperor of Japan, and residing in the borough of Manhattan, in the city and State of New York, have invented certain new and useful Improvements in Electric Clocks, of which the following is a specification.

My invention relates to electric clocks and more particularly to that class of electric clocks actuated by an electric impulse, and my invention has for its object to provide an electric clock wherein the electric impulse is only received when the impulse of the balance wheel weakens.

My invention furthermore has for its object to provide a simple actuating mechanism, permitting the hour and the minute hands of the clock to be turned forward or backwards independently of said mechanism.

Further objects of my invention are to provide many improved details of structure whereby the above results are obtained, such details being clearly shown in the accompanying sheets of drawings in which like reference characters refer to like parts, and in which

Figure 1 is a general outside perspective view of a clock constructed in accordance with my invention. Fig. 2 is a side view of the same with the side of the casing removed. Fig. 3 is a bottom view of my improved clock. Fig. 4 is a general inside view showing a rear elevation of the mechanism embodied in the clock, with the rear plate removed. Fig. 4$^a$ is a plan view of the seconds wheel shaft, its worm, the minute and hour wheel driving shaft and the drivers and clutch mounted thereon. Fig. 5 is a detail view illustrating the attraction of the actuating lever to the electro-magnet, and showing the means for communicating motion from said lever to the second wheel. Fig. 6 is a detail view, showing a portion of the structure shown in Fig. 5. Fig. 7 is a detail view, showing the balance wheel and the means for throwing the electro-magnet into circuit upon the weakening of the impulse of the balance wheel. Figs. 8 and 9 are detail views of a portion of the structure shown in Fig. 7, showing different positions of the parts. Fig. 10 is a diagrammatic view showing the magnetizing circuit.

Referring now in detail to the drawings: 1 represents the casing of my improved clock having mounted therein the face 2 carrying the usual dial and hands and having in addition thereto the second dial 3 having a hand 3′ and the alarm dial 4 having a hand 4′.

5 is the front plate of the inner frame of the clock mechanism connected to the back plate 6 of said frame by posts 7. Mounted in the frame of the clock is an arbor 8 upon which is mounted the usual balance wheel 9 and the customary hair spring 10. Pivoted in juxtaposition to the balance wheel 9 is a bifurcated oscillatory lever 11 held normally in balanced position by a coil spring 12 wound on the arbor 13 of said lever. The lever 11 is provided with a curved outer end 14 adapted to engage a pin or projection 15 carried by the balance wheel 9.

16 represents what I term the actuating lever. Lever 16 is pivoted at 17 to a portion of the plate 6 and is provided at its lower end with an armature 18 adapted to be attracted by an electro-magnet 19 when a current is thrown through such magnet, (Figs. 4 and 5). The attraction of the armature 18 to the magnet 19 produces an oscillation of the actuating lever 16, which lever having a forked upper end 20 engaging a pin 21 on the balance wheel 9 produces an impetus to said balance wheel in opposition to the hair spring 10. Pivoted to the lever 11 is a contact arm 22 having at its upper end a pin or projection 23 adapted to engage one of the pair of contact points 24, one of said points 24 being electrically connected to the battery of the clock and the other of said contact points being electrically connected to the electro-magnet 19. (Fig. 10). The contact arm 22 is provided at its lower end with a curved face so that during normal oscillations of the balance wheel 9, the pin 15 will pass under said arm without engaging the same. This occurs by reason of the fact, (Figs. 4, 7, 8 and 9), that when the pin or projection 15 strikes the curved end 14 of the lever 11, it forces the lever upwardly carrying the arm 22 therewith, said lever being forced upwardly with sufficient force to allow the pin 15 to pass under the arm 22 and return before the descent of the lever 11. If the oscillations of the balance wheel 9 grow weak the pin or projection 15 obviously strikes the curved end 14 with less force so that the arm 22 is not carried high enough to escape contact with the said pin 15. In such case pin 15 will strike the lower end of the arm 22 oscillating the

same in opposition to one of the contact points 24 and bringing such points into contact to close the circuit through the magnet 19, whereupon the armature 18 on the actuating lever 16 will be again attracted and the foregoing operation repeated. Arm 22 is held in its normal position against one of the contact points 24 by a spring 25, (Fig. 8). The lever 11 is bifurcated to more evenly balance the same in its operation.

26 is what I term the seconds wheel provided with sixty notches and pivoted on a shaft 27 journaled in the plates 5 and 6, (Figs. 4 and 5), and hereinafter referred to as the seconds shaft. 28 is a dog pivotally mounted on the actuating lever 16 and adapted to engage the notches in the seconds wheel 26.

29 is a pawl pivoted to the actuating lever 16 and held in engagement with the notches in the seconds wheel 26 by a spring 30, (Figs. 5 and 6). Upon the vibration of the actuating lever 16, as will be readily seen, the seconds wheel 26 through the medium of pawl 29 is fed forward one step or notch for each oscillation of the actuating lever 16. The seconds wheel 26 through its shaft 27 communicates motion to a worm 31 which in turn through engagement therewith communicates motion to a worm wheel 32 frictionally mounted on a shaft 33 horizontally mounted in the clock-frame. Shaft 33 carries a worm gear 36 which engages the teeth of the hour wheel 37.

38 is a pinion also mounted upon the shaft 33 and adapted to engage the teeth of the minute wheel 38[a]. It will thus be seen that upon the oscillation of the balance wheel 9, whether the same is being attracted by the electro-magnet 19 or not, motion is communicated through the seconds wheel 26 and shaft 27 to the shaft 33 through worm 31 and worm wheel 32 and the minute wheel and the hour wheel thereby rotated. Such gear is so arranged that the hour wheel will rotate twice in every twenty-four hours, the minute wheel once every hour, and the seconds wheel once every minute.

39 is a shaft journaled in the clock-frame and having at its outer end a thumb-wheel 40 without the clock. Shaft 39 extends into the interior of the clock mechanism and has at ts inner end a pinion 41. Shaft 39 is adapted to be drawn outwardly in opposition to a spring 42 into engagement with a pinion 43 carried by the shaft 33 so that the shaft 33 may be rotated in either direction by the shaft 39. In order that the shaft 33 and the minute and hour wheels may be reversed without communicating motion to the second wheel, I have provided a frict onal connection between the shaft 33 and the pinion 32, such connection consisting in a clutch member adapted to be forced into engagement by a spring 44.

In Fig. 10 I have shown diagrammatically the electric circuit employed in connection with my improved clock, wherein the contact pieces 24 form a part of the circuit through wire 152, the electro-magnet 19, wire 153, battery 154, and wire 155.

In Figs. 2 and 3 I have shown a convenient arrangement of the battery 154 and the clock mechanism within a casing, wherein the casing 1 is divided into two sections or compartments separated by a partition 160. In the rear compartment is located the battery 154 being retained in said compartment by lugs 161 engaging eyes 162, said lugs being locked in engagement with said eyes by means of spring-pressed pins 163 passing through said lugs and eyes. In the forward part of the casing I locate the clock mechanism hereinbefore described. Any suitable electric connection may be employed between the said battery and said mechanism, such for instance as that shown in Fig. 10.

I do not wish to be understood as limiting my invention to the exact details of structure herein shown, inasmuch as the same may be varied considerably without departing from the spirit of my invention.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. In a clock, the combination with the balance wheel and the hair spring, of an actuating lever for said balance wheel, an electromagnet adapted to attract said lever, circuit closing contact pieces electrically connected to said magnet, a balance governing lever, a contact arm mounted on said governing lever for closing a circuit through said contact pieces, and means on said balance wheel for engaging said contact arm to close a circuit, but adapted when the force of oscillation of the balance wheel is of sufficient strength to strike said governing lever with sufficient force to displace the same and carry said contact arm out of the path of engagement.

2. In a clock, the combination with the balance wheel, an electrical means for impelling said balance wheel when a circuit is closed, circuit closing devices, a balanced governing lever, a pivoted contact arm mounted on said lever and adapted when actuated to engage said circuit closing devices to close a circuit, and means carried by the balance wheel for engaging said contact arm to close a circuit, but adapted when the force of oscillation of the balance wheel is of sufficient strength to strike said governing lever with a force sufficient to displace the same and carry said contact arm out of the path of engagement.

3. In a clock, the combination with a balance wheel, means for electrically impelling said balance wheel, circuit closing contact devices for controlling an electrical impulse,

a balanced governing lever, a contact closing arm pivoted on said lever and in engagement with one of said circuit closing devices, and means carried by the balance wheel for striking said governing lever and intermittently engaging said contact closing arm and depending for its intermittent engagement with said contact closing arm upon the force of its blow upon said governing lever.

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