Dec. 15, 1953 F. KOEHLER 2,662,366

ELECTRIC WATCH

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FIG. 1

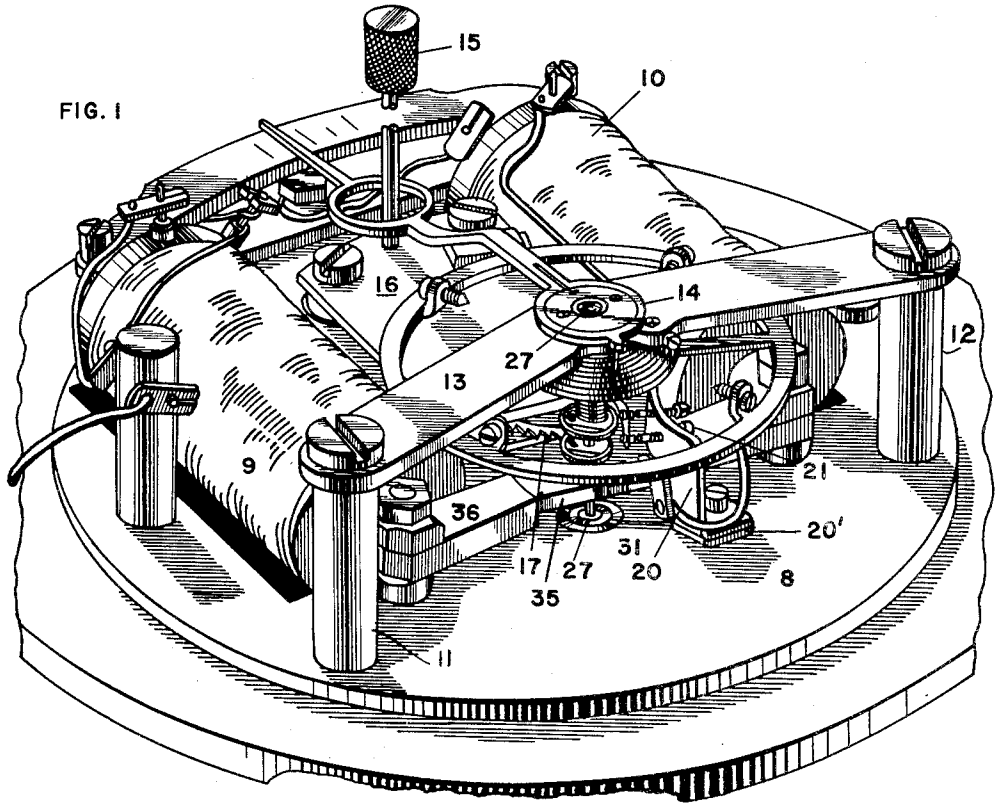
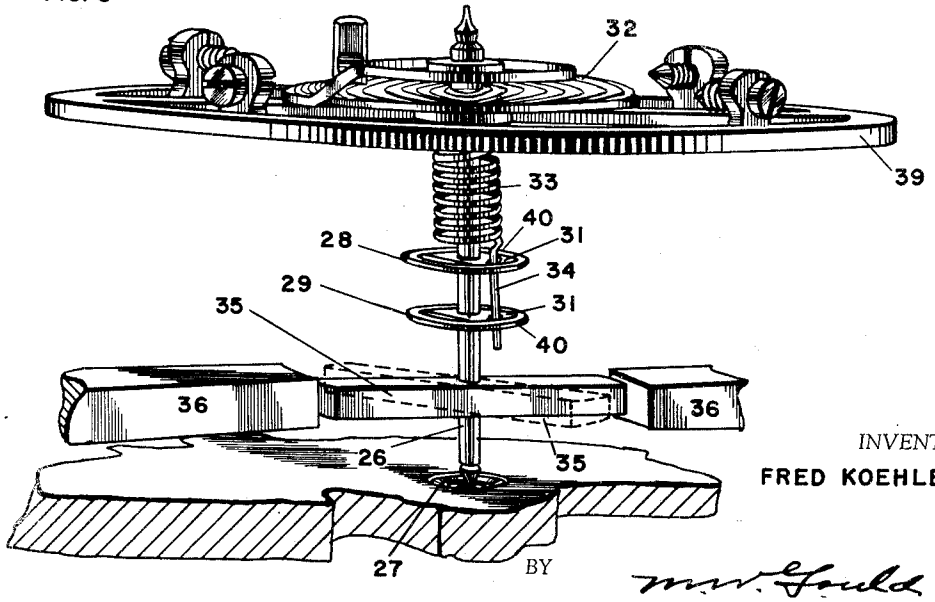


FIG. 3



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FIG. 2

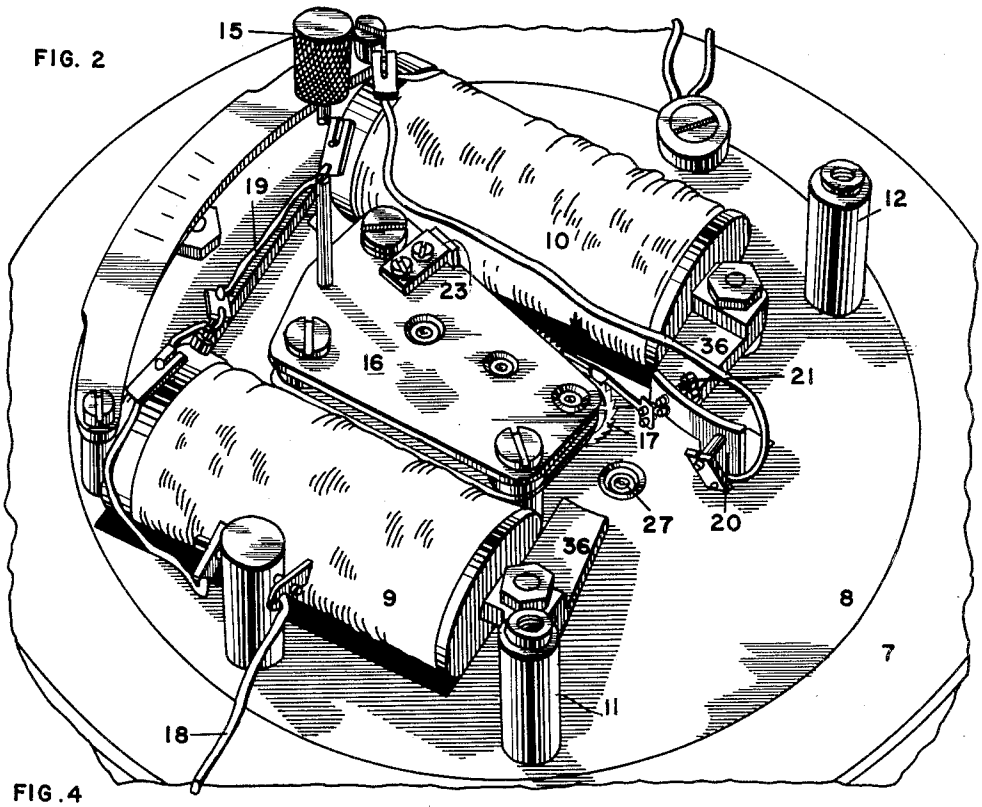


FIG. 4

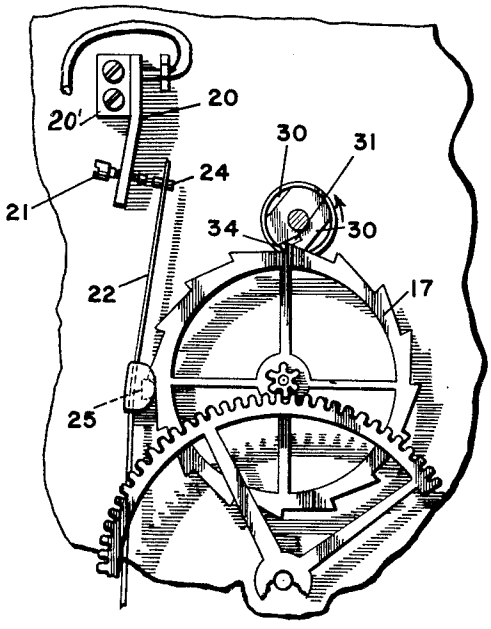
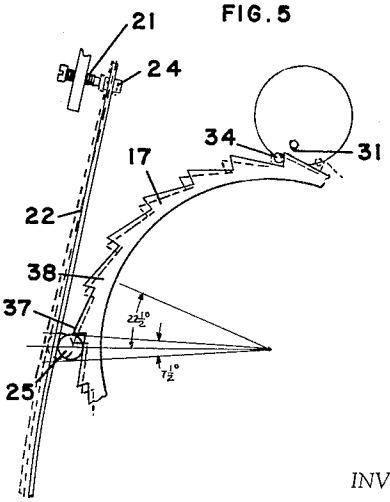


FIG. 5



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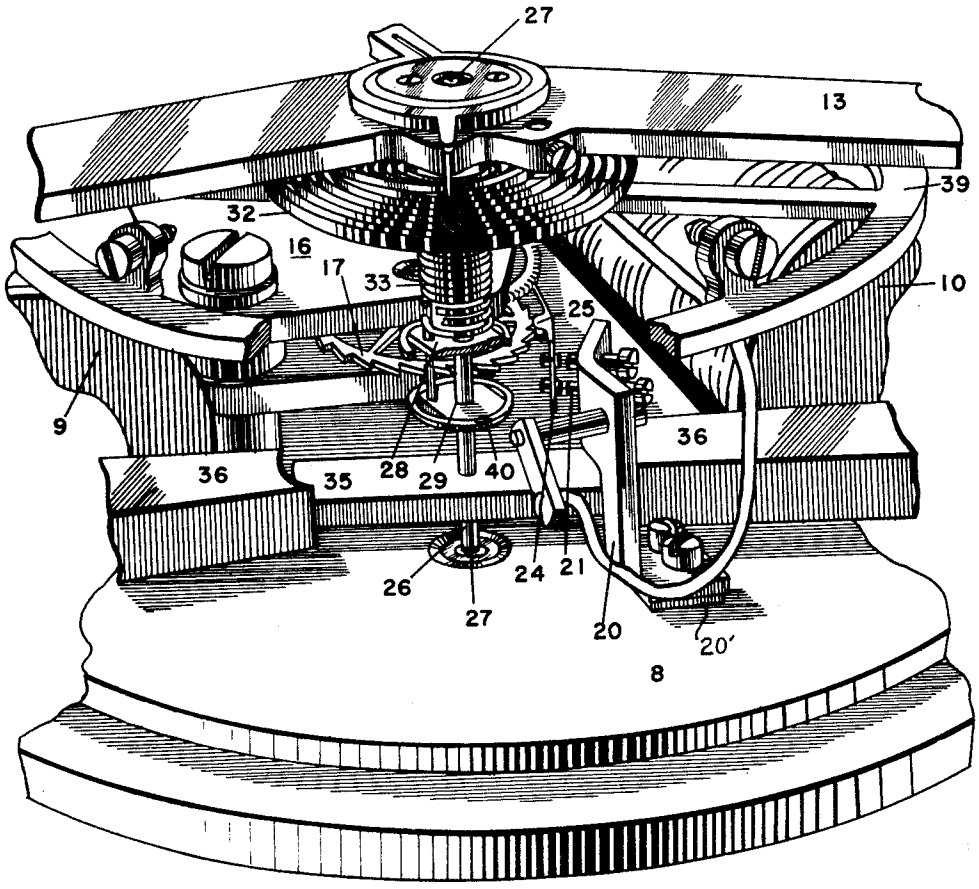
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FIG. 6



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UNITED STATES PATENT OFFICE

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ELECTRIC WATCH

Fred Koehler, Lancaster, Pa., assignor to Hamilton Watch Company, Lancaster, Pa.

Application October 19, 1951, Serial No. 252,079

6 Claims. (Cl. 58—28)

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This invention relates to a watch adapted to be motivated by a magnetic impulse and where the balance wheel serves both as the driving element and the regulating element.

The object of the present invention is to provide an electric watch which utilizes an absolute minimum of power.

Heretofore, attempts have been made to make electric watches which are operated by a small flashlight battery for a period of a year but such attempts have failed because of the large expenditure of power required in the running of the watch.

The present invention overcomes that difficulty by utilizing every last particle of power delivered by the magnetic impulse to advance the hands of the watch.

It is a further object of the present invention to provide a toothed gear wheel adapted to be engaged by a spring to advance the mechanism in half second increments and to actuate at the same time the contact making spring.

It is a further object of the present invention to utilize the motion of the contact making spring for wiping and cleaning the contacts and the return resiliency of the spring assists and finally positions the hands of the watch by impinging against the teeth of the toothed gear.

It is a further object of the present invention to locate the position of the contact making spring so that its engagement with the toothed gear assures the correct position of the teeth of the toothed gear for engagement with the advancing spring of the balance wheel.

The invention is shown in the accompanying drawings in which:

Figure 1 is a top perspective view of the watch.

Figure 2 is a similar view with the balance wheel assembly removed.

Figure 3 is an enlarged view of the balance wheel assembly.

Figure 4 is a detail view showing the engagement of the advancing spring with the toothed gear and the engagement of the toothed gear with the contact making spring.

Figure 5 is a diagrammatic view demonstrating the angular relation at the contact points of both the advancing spring and the contact making spring.

Figure 6 is an enlarged view showing a section of the movement from the front.

Referring particularly to Figures 1 and 2, a base 7 has mounted thereon a plate 8 on which is carried a pair of magnetic coils 9 and 10. Posts 11 and 12 secured to the plate 8 carry a bridge

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13 which supports the balance wheel assembly. A regulator 14 similar to that used for regulating the effective length of the hairspring is mounted as usual. A setting stem 15 connects with a train 16 to set the hands (not shown) in the usual manner. The train is of the usual type with the exception of the toothed gear 17 and is not shown except as between the two supporting plates.

Current enters from the wire 18, passes through the coil 9, then by wire 19 to the coil 10 and from coil 10 to the contact supporting posts 20. An insulated block 20' serves to prevent shorting of the current and insulates the supporting posts 20 from the plate 8.

The supporting posts 20 carry contacts 21 which are shown here in duplicate but which could be any number. A contact making spring 22 is supported by a clamp 23 carried on the train 16 and itself supports a pair of contacts 24 for engagement with the contacts 21. A carboloy cam 25 is carried centrally of the spring 22 for engagement with the teeth of the toothed wheel 17. This engagement will be explained in detail later.

The posts 11 and 12 support a bridge 13 which carries the balance wheel staff 26, which is supported in the usual bearings 27. The balance staff is formed with a pair of integral annular flanges 28 and 29 which are formed with flattened sides 30 and a notch 31. The balance wheel has the usual hairspring 32 and also carries an additional coil spring 33, the lower end of which extends through the notches 31 of the flanges 28 and 29 between which the toothed gear 17 moves into the path of oscillation of the end 34 of the spring 33.

Referring particularly to Figure 3, the balance wheel assembly is shown with a magnetic arm 35 passing between the poles of the magnets 36. The dotted position of the bar 35 shows the instant at which the contacts 21 and 24 make and the surge of magnetic attraction through the ends of the cores 36 swings the arm 35 through the balance wheel assembly until the point 37 of one of the teeth 38 of the toothed gear 17 passes the center point of the carboloy cam 25. The tension of the spring 22 which has been pushed into the dotted line position shown in Figure 5 causes the cam 25 to advance the toothed gear 17 sufficiently to permit said cam 25 to drop beside the tooth, thus breaking the contact. This is done at the moment when the edge of the bar 35 is opposite the edge of the end of the cores 36. The advancement of the toothed gear 17 is accomplished

by contact with the edge of the teeth by the end 34 of the spring 33. Referring to Figure 4, movement of the annular flanges 28 and 29 is, of course, oscillatory and when moving in the direction of the arrow, the spring 34 engages the teeth of the gear 17 advancing the tooth to move the contact 24 into contact making position. The subsequent movement of the spring arm 22 bears against the flat of the teeth 38 and holds the teeth for engagement with the wire 34 at the exact right moment.

Referring particularly to Figure 6, it is thought that the action of the movement may be clarified by pointing out the cycle of movement in this view. The balance wheel 39 carries on its staff 26 the flanges 28 and 29. These flanges are formed with angled notches 31 which are aligned, shown in Figure 1, and receive the end 34 of the coiled spring 33. A ring 40 engages the perimeter of the flanges 28 and 29 to retain the end 34 of the spring 33 within the notches 31. Located between the flanges 28 and 29 is the tooth driven wheel 17. By referring to Figure 4 it is clear that motion of the balance wheel 39 will bring the end 34 of the spring into engagement with the teeth of the wheel 17 when moving in a counter-clockwise direction, and when moving in a clockwise direction the end of the spring 34 will ride over the teeth of the wheel 17 by moving in the angled notches 31, the spring end 34 being retained in the notches by the ring 40. This construction permits the end 34 to serve as a rigid advancing bar when moving in a counter-clockwise direction and a resilient spring end when moving in a clockwise direction.

By referring further to Figure 5, the advancement of the toothed wheel 17 by the spring end 34 moves the cam 25 to close the contacts between 24 and 21. Due to the length and flexibility of the spring 22, the contact 24 wipes slightly across the face of the contact 23 during the contact making motion. This slight wiping action is sufficient to keep the pair of contacts free of oxidation. The motion of the wheel 17, however, through the action of the spring end 34 is such that as the cam rides over the tooth 37 the action of the spring 22 urges the toothed wheel 17 in a clockwise direction until the cam drops into the position shown in Figure 5. With the dropping of the cam into position in Figure 5, the pressure of the spring 22 is directed toward the center of the wheel 17 and against the angled surface of the tooth. This pressure tends to seat the cam 25, as shown in Figure 5, with contact at two surfaces of the toothed wheel, thus holding the toothed wheel in the exact proper position to be engaged by the end 34 of the spring 33 on the next swing of the balance. Each of the teeth on the wheel 17 covers an arc of 15°. The rotation of the wheel 17 caused by the pin 34 amounts to 11° of this arc, while the remaining 4° of arc is caused by the pressure of the cam 25 against the upper edge of one of the teeth (as shown in dotted lines in Figure 5), thus utilizing the resiliency of the spring 22 to return to its normal position. By reason of the length of the spring 22 and the distance between the cam 25 and the contact 24, the movement at the end of the spring where the contact 24 is mounted is rapid. This quick make and break also serves to prevent any carbonization of the contacts which is also assisted by the slight wiping action of the contacts across each other also caused by the length and flexibility of the spring 22. It will thus be seen that the work done against the spring 22 in closing the contacts between 21 and 24 is partially recovered by the movement of the wheel 17 through the action of the cam 25 bearing against the tooth 37. By utilizing this energy of the spring and by maintaining the movement free of extra parts, it is possible to run such a watch on the smallest flashlight battery made for periods of six months and upwards.

What is claimed is:

1. An electric watch movement, comprising a base, an electromagnet mounted on said base, a battery in circuit with said electromagnet carried by said base, a balance wheel, balance staff and hairspring assembly mounted for oscillation on said base, an armature carried by said balance staff adapted to be impulsed at regular intervals by said electromagnet, a coil spring secured to said balance wheel and encircling said balance staff and oscillating therewith, the free end of said spring extending downward parallel to said balance staff, a pair of vertically spaced flanges carried by said balance wheel and formed with notches for receiving the free end of said spring, means for retaining said spring end within said notches, a toothed wheel mounted to rotate parallel to said balance wheel and partially within and between said flanges, the teeth of said wheel being engaged by said spring end during the oscillation of said balance wheel whereby said wheel is progressively indexed, and means actuated by said indexed wheel for making and breaking said circuit between said battery and said electromagnet.

2. An electric watch movement of the type to be operated on a minimum of electric current, comprising a base, a battery carried by said base, an electromagnet mounted on said base and in circuit with said battery, a balance wheel, balance staff and hairspring assembly mounted for oscillation on said base, an armature carried by said balance staff and impulsed at predetermined intervals by said electromagnet, a coil spring surrounding said balance staff and connected to said balance staff at one end, the free end of said spring terminating in a spring finger, a pair of vertically spaced flanges carried by said balance staff and formed with notches for receiving the spring finger, a toothed wheel adapted to rotate in a plane parallel to said balance wheel and to extend between said flanges and to be engaged and advanced one tooth by said spring finger when moving in a counter-clockwise direction, the spring finger retreating in the notches to pass over said teeth when moving in a clockwise direction, a spring carrying a pair of contacts for making and breaking the circuit between the battery and said electromagnet, a cam carried on said spring engaging said toothed wheel, movement of said toothed wheel under the influence of said spring finger moving the cam and its spring to make and break the electric circuit, the return spring motion of the cam serving to assist the indexing motion of the toothed wheel.

3. An electric watch movement of the type to be operated on a minimum of electric current, comprising a base, a battery carried by said base, an electromagnet mounted on said base and actuated by said battery, a balance wheel, balance staff and hairspring assembly mounted for oscillation on said base, an armature bar carried by said balance staff and impulsed by said electromagnet at predetermined intervals, a coil spring surrounding said balance staff and connected at one end to said balance staff and oscil-

lating with said staff, the free end of said spring terminating in a downwardly projecting spring finger, a pair of spaced flanges carried by said balance staff and notched to receive said spring finger, a toothed wheel adapted to be indexed by said spring finger in one direction, a spring arm, a cam carried by said spring arm and engaging the teeth of said indexed wheel, a pair of contacts on the end of said spring arm, a second pair of contacts connected in the circuit between said battery and said electromagnet mounted in the path of movement of said spring arm, the indexing of the wheel by said spring finger moving the spring arm through the cam to provide a wiping action of one pair of contacts over the other pair of contacts.

4. An electric watch movement of the type to be operated on a minimum of electric current, comprising a base, a battery mounted on said base, an electromagnet mounted on said base and actuated by said battery, a pair of stationary contacts connected to said battery, a balance staff, balance wheel and hairspring assembly mounted for oscillation on said base, a coil spring carried by said balance staff and oscillating therewith having its lower end projected downward to form a spring finger, a pair of spaced flanges carried by said balance staff and formed with notches engaging said spring finger, said flanges having rims to retain the finger within the notches, a toothed wheel mounted for rotation in a plane parallel to said balance wheel and in the path of movement of said spring finger, said toothed wheel to be progressively advanced by said spring finger during the oscillation of the balance wheel in one direction, the return oscillation forcing the finger up into the notches and permitting said finger to ride past the teeth without disturbing the toothed wheel, a spring carrying a pair of contacts, an arcuate faced cam mounted on said spring and engaging the toothed wheel, motion of the toothed wheel through contact with the spring finger riding the arcuate cam to the top of one of the teeth and engaging the spring carried contacts with the stationary contacts to complete the electric circuit, pressure of the spring through the arcuate faced cam acting on the teeth to slightly index the toothed wheel to a predetermined position.

5. An electric watch movement of the type to be operated on a minimum of electric current, comprising a base, a battery carried by said base, an electromagnet mounted on said base and in circuit with said battery, a balance wheel, balance staff and hairspring assembly mounted for oscillation on said base, an armature carried by said balance staff and impulsed at predetermined intervals by said electromagnet, a coil spring surrounding said balance staff and connected to said balance staff at one end, the free end of said spring terminating in a spring finger, a pair of vertically spaced flanges carried by said balance staff and formed with notches for receiving the spring finger, a toothed wheel adapted to rotate in a plane parallel to said balance wheel and to extend between said flanges and to be engaged and advanced one tooth by said spring finger when moving in one direction, the spring finger retreating in the notches to pass over said teeth when moving in the opposite direction, contact means in said circuit, a spring associated with said contact means for making and breaking the circuit, a cam carried on said spring engaging said toothed wheel, movement of said toothed wheel operating the contact means through said spring finger, the return spring motion causing the cam to assist the indexing motion of the toothed wheel.

6. An electric watch movement of the type to be operated on a minimum of electric current, comprising a base, a battery mounted on said base, an electromagnet mounted on said base and actuated by said battery, stationary contact means connected to said battery, a balance staff, balance wheel and hairspring assembly mounted for oscillation on said base, a coil spring carried by said balance staff and oscillating therewith having its lower end projected downward to form a spring finger, a pair of spaced flanges carried by said balance staff and formed with notches engaging said spring finger, said flanges having rims to retain the finger within the notches, a toothed wheel mounted for rotation in a plane parallel to said balance wheel and in the path of movement of said spring finger, said toothed wheel to be progressively advanced by said spring finger during the oscillation of the balance wheel in one direction, the return oscillation forcing the finger backward in the notches and permitting said finger to ride past the teeth without disturbing the toothed wheel, a spring having contact means thereon adapted to engage the stationary contact means, an arcuate faced cam mounted on said spring and engaging said toothed wheel, motion of the toothed wheel through contact with the spring finger riding the arcuate faced cam to the top of the teeth causing the spring carried contact means to contact the stationary contact means to complete the electric circuit, the resulting pressure of the spring through the arcuate faced cam acting on the teeth to slightly index the toothed wheel to a predetermined position.

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