

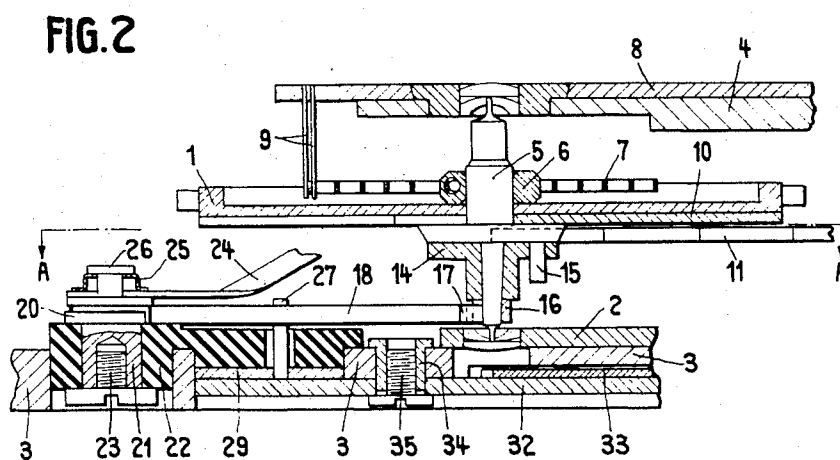
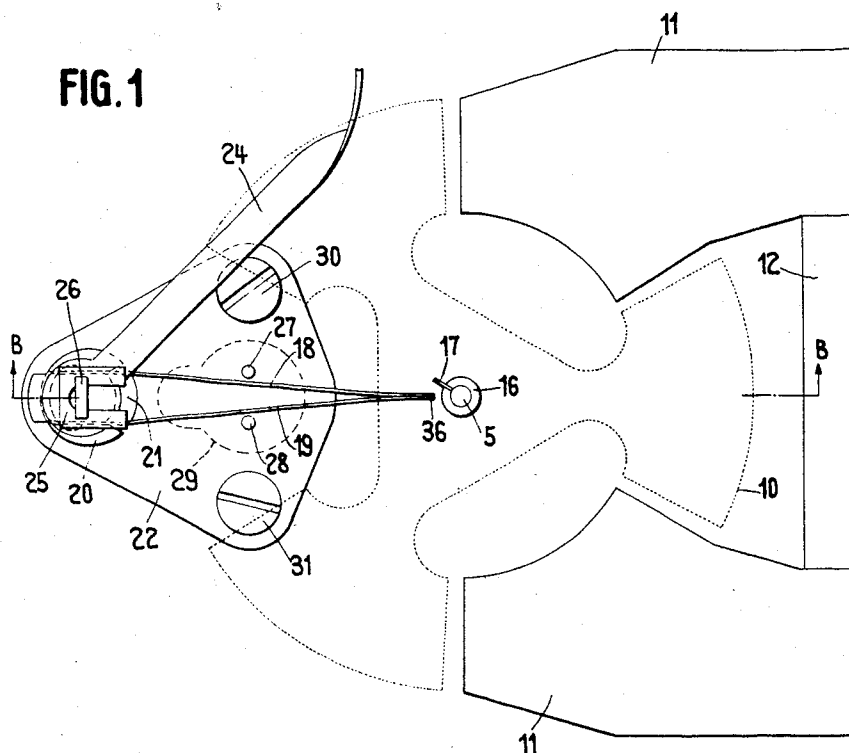
Sept. 30, 1958

A. BEYNER
ELECTRIC TIMEPIECE

2,853,849

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 3

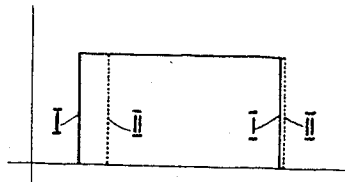


FIG. 4

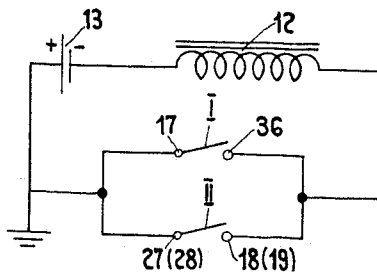


FIG. 5

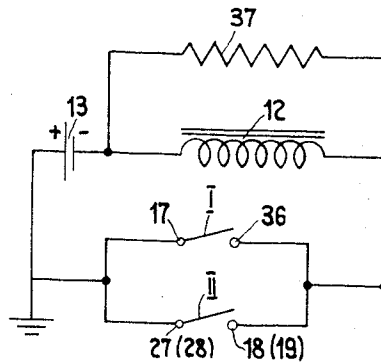


FIG. 6

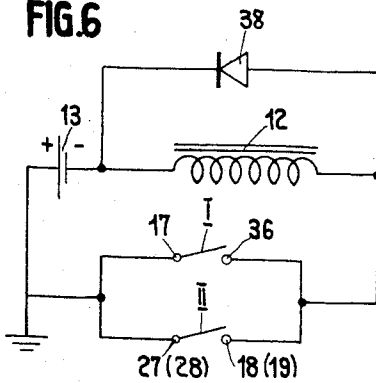
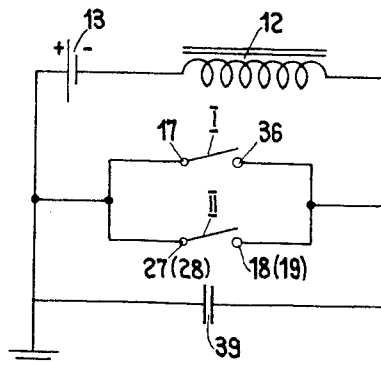


FIG. 7



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1

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ELECTRIC TIMEPIECE

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4 Claims. (Cl. 58—28)

The present invention relates to an electric timepiece. In electric watches with driving balance the problem of the contact is difficult to solve. This contact closes at a relatively high frequency. Moreover, it must have an absolutely reliable operation with very small contact pressures. On the other hand, its wear and tear should be minimized so as to make the service life of the contact as long as possible. This wear and tear has generally two distinct reasons. On the one hand, there is a mechanical wear and tear, produced by the friction of the contact parts and, on the other hand, the electrical wear and tear, also called electrical erosion, produced by the break spark occurring at the moment of the opening of the contact. This erosion gradually eats away the contact part which is connected to the positive pole of the feeding battery, so that the mechanical contact finally becomes insufficient or even non-existent.

The invention aims at overcoming these drawbacks. For this purpose, the electric circuit for keeping up the oscillations of the balance comprises two contacts mounted in parallel and arranged in such a way that their closing periods are slightly staggered but partially superposed, the first of the said contacts, which is directly controlled by the rotation of the balance, always closing and opening before the second contact, so that no breaking extra-current takes place on the first contact.

The accompanying drawings show, by way of example, one embodiment and some modifications of an electric timepiece in accordance with the invention. There is shown in the drawings only what is necessary for an understanding of the invention.

Fig. 1 is a plan view of this embodiment, seen along the line A—A of Fig. 2.

Fig. 2 is a sectional view taken along the line B—B of Fig. 1.

Fig. 3 is a diagram showing the closing period of each of the contacts.

Fig. 4 shows a diagram of the circuit for keeping up the oscillations of the balance.

Figs. 5 to 7 illustrate some modifications of the diagram of Fig. 4.

The construction illustrated in the drawings comprises a driving balance 1 which is pivoted in a plate 2 rigidly fixed to the pillar-plate 3 and in the cock 4. On the balance staff 5 is secured a collet 6 to which is attached the inner end of a hairspring 7 of conventional type, the other end of which is fixed to the cock 4, for instance by means of a stud. A regulator 8 of a known construction, carrying pins 9, permits regulating the active length of the hairspring 7.

On the balance staff 5 is rigidly secured a movable three-armed armature 10, cooperating with the pole shoes 11 of an electromagnet provided with a coil 12 forming part of the electric circuit illustrated in Fig. 4. This assembly forms a motor with axial gap, the operation of

2

which is the same for both directions of rotation of the balance 1. The coil 12 is connected to a battery 13 (Fig. 4) and to two contacts I and II mounted in parallel, described later, which are connected to the battery 13 and to the earth. The staff 5 carries in addition a roller 14 provided with a pin 15 extending downwards. For the sake of clarity the roller 14 is not illustrated in Fig. 1.

Below the roller 14 is rigidly fixed to the balance staff 5 a ring 16 having a finger 17. This assembly rotates with the staff 5 and forms the control part of the contact I.

A U-shaped leaf, both legs of which are hereinafter called the lamellae 18 and 19, is fixed by means of a key 20 into a milled tenon 21. The latter is itself held in an insulating plate 22 by means of a screw 23. The lamellae 18 and 19 are slightly deformed elastically and bear on each other at their free ends 36. The length of the lamellae 18, 19 is such that when the finger 17 moves, it encounters in its trajectory the ends 36 of these lamellae (see Fig. 1). A bar 24 for supplying the current is fixed on the tenon 21 by means of a key 25, maintained under pressure by the head 26 integral with the tenon 21.

Two pins 27 and 28 are held in a small plate 29 which is in contact with the earth (positive pole of the battery 13). The small plate 29 is maintained in its place by the insulating plate 22, which is itself fixed to the pillar-plate 3 (earth) by two screws 30 and 31. The small plate 29 also bears against a bridge 32 serving to axially secure the minute wheel 33. The bridge 32 is fixed to the pillar-plate 3 by means of a cannon 34 and a screw 35. The pins 27 and 28 are placed, when seen in a plan view (Fig. 1), outside the lamellae 18 and 19. When the contact is at rest, i. e. when the finger 17 of the balance staff 5 does not touch the lamellae 18, 19, there exists a space between the lamellae 18, 19 and the respective pins 27, 28.

The contact I shown in Fig. 4 is made between the finger 17 and the ends 36 of the lamellae 18, 19, whereas the contact II connects, when it closes, one of the pins 27, 28 with the corresponding lamella 18, 19. The polarity of the contacts is such that the pins 27, 28 are positive with respect to the lamellae 18, 19 and the finger 17 is positive with respect to the said lamellae.

The electric circuit for keeping up the oscillations of the balance 1 comprises the following elements: negative pole of the battery 13, coil 12, bar 24, tenon 21, lamellae 18 and 19. Therefrom, the circuit is subdivided into two parallel branches. The first one, over the contact I, leads to the finger 17, to the balance staff 5, to the collet 6, to the hairspring 7, to the cock 4 and hence to the earth and to the positive pole of the battery 13. The second branch, over the contact II, comprises the pins 27, 28, the small plate 29, the pillar-plate 3, the earth and the positive pole of the battery 13.

The operation is as follows:

Let us first suppose that the balance 1 rotates in the counter-clockwise direction of Fig. 1. Upon closing of the contact I between the members 17 and 36, there is not yet any contact between the lamella 19 and the pin 28. When the balance 1 further rotates, the finger 17 acts on the lamellae 18 and 19. The lamella 19 comes nearer to the pin 28 and finally touches it, thus closing the contact II (Figs. 3 and 4). At this moment, both contacts I and II are simultaneously closed. As the balance 1 further rotates, the finger 17 leaves the ends 36 of the lamellae and then the lamella 19 leaves the pin 28. The contacts I and II open almost simultaneously but it is the contact II (between the members 19 and 28) which opens last, as will be explained hereinafter. As a matter of fact, when the finger 17 acts on the

lamellae 18 and 19, the ends of the latter slightly slide on each other. At a certain moment, the end of the lamella 18 escapes the finger 17 which then only acts onto the lamella 19. Meanwhile, the contact II remains closed (between the members 19 and 28) and the finger 17 elastically deforms the lamella 19 until the end of the latter also escapes the finger 17. The contact I now opens, and then the lamella 19, getting upright under the action of its elasticity, leaves the pin 28 and comes again to bear against the other lamella 18, thus breaking the contact II. It will be seen that the contact I very suddenly opens, because the finger 17 moves with a high velocity, whereas the contact II slowly opens, when the finger 17 has left the lamella 19. Fig. 3 shows the closing period of each contact. The contact II closes somewhat later than the contact I; then both contacts are closed simultaneously during a certain lapse of time; and then the contact I opens first, immediately followed by the contact II.

The closing of the contact I causes the current to pass through the coil 12 and provokes an electromagnetic impulse onto the movable armature 10. After this impulse, the balance 1 travels over its first supplementary arc of oscillation, and then comes back in the clockwise direction under the action of the hairspring 7. During this movement, the finger 17 strikes against the lamella 19 (contact I), whereas the contact II is made somewhat later between the lamella 18 and the pin 27, the operation being the same as described above for the movement of the balance 1 in the counter-clockwise direction. A new impulse is therefore given to the balance 1, which then travels over its second supplementary arc of oscillation and comes back into its starting position under the action of the hairspring 7, and then the described cycle begins again. In Fig. 1, the parts are shown in the position corresponding to the moment at which the balance 1, rotating in the counter-clockwise direction, is being to close the contact I between the finger 17 and the lamella 18.

It results from the preceding that the break spark, which normally takes place upon the opening of a contact, does not occur on the contact I (finger 17, end 36 of the lamellae), but on the contact II, i. e. on the contact made between one of the pins 27, 28 and the corresponding lamella 18, 19. Since the polarity has been chosen such that these pins 27, 28 be positive with respect to the lamellae 18, 19, the occurring electrical erosion is made to the detriment of the pins 27, 28. The lamellae 18, 19, therefore, do not practically undergo any wear and tear and their dimensions will remain unchanged. As it is this part of the contact which effects the control, the latter will always remain identical in course of time. On the contrary, the contact II must be built so as to support the effects of the electric spark. This construction is possible, since the pins 27, 28 may be relatively massive with respect to the lamellae 18, 19.

It is still possible to improve the operation of the contact II by providing protective means against the spark. These means are shown in Figs. 5 to 7 and consist in connecting either an ohmic resistance 37 (Fig. 5) or a diode 38 (Fig. 6) at the terminals of the coil 12, or else in mounting a condenser 39 (Fig. 7) in parallel with both contacts I and II. By using these means, the danger of the spark is reduced to a large extent and the durability of the contact II is increased.

The oscillations of the balance 1 are transformed into a uni-directional movement by a non-illustrated escapement of a known type, not forming part of the invention. This escapement then drives in a known manner the gears and the hands of the timepiece.

The described device offers many advantages, namely:

(a) The contact I has no excessive charge to support upon opening of the contact, i. e. no breaking extra-current, so that there is no danger of electrical erosion on the parts of this contact.

(b) Both contacts I and II are in parallel and their closing periods are superposed over their major portion. The probability of obtaining a good contact is thus increased to a large extent by reason of the compensation of the irregularities inherent in every contact.

(c) The operation pressures may be very small.

(d) There is no danger of recoil, as the inertia effects are tiny.

(e) The electrical and mechanical operation is absolutely reliable.

(f) The electrical and mechanical wear and tear is minimized.

(g) The construction is simple and rugged.

(h) All of the elements of the contact can be separately interchanged in a very simple manner.

Instead of using a motor giving one impulse to the balance 1 at each half-oscillation, it is also possible to provide the case in which every second half-oscillation is impulse-free. In this case, one of the pins 27, 28 might for instance be dispensed with and the finger 17 might be insulated on one of its faces.

The invention applies to any timepiece and more particularly to watches and small clocks.

While a representative embodiment and details have been shown for the purpose of illustrating the invention, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit or scope of the invention.

I claim:

1. An electric timepiece comprising an electromagnetically driven balance wheel assembly, a battery, a contact finger fixedly carried by said balance wheel assembly and connected to the positive pole of the battery, a spring contact arm, an electromagnet connected to the negative pole of the battery and to the spring contact arm, a fixed pin connected to the positive pole of the battery, the spring contact arm adapted to engage said finger and said pin, thus closing two contacts, the first contact being made between said finger and the free end of said spring contact arm and the second contact being made between a portion of said spring contact arm remote from its free end and said pin, said contacts being mounted in parallel and arranged in such a way that their closing periods are slightly staggered but partially superposed, the first contact always closing and opening before the second contact, so that no breaking extra-current takes place on the first contact.

2. An electric timepiece comprising an electromagnetically driven balance wheel assembly, a battery, a contact finger fixedly carried by said balance wheel assembly and connected to said battery, an electromagnet, a spring contact arm connected to said electromagnet, a fixed pin connected to said battery, the spring contact arm adapted to engage said finger and said pin, thus closing two contacts, the first contact being made between said finger and the free end of said spring contact arm and the second contact being made between a portion of said spring contact arm remote from its free end and said pin, said contacts being mounted in parallel and arranged in such a way that their closing periods are slightly staggered but partially superposed, the first contact always closing and opening before the second contact, so that no breaking extra-current takes place on the first contact.

3. An electric timepiece comprising an electromagnetically driven balance wheel assembly, a battery, a contact finger fixedly carried by said balance wheel assembly and connected to said battery, an electromagnet, two spring contact arms connected to said electromagnet, two fixed pins connected to said battery and mounted in proximity to said spring contact arms, the spring contact arms adapted to engage said finger and said pins, thus closing two contacts, the first contact being made between said finger and the free end of one of said spring contact arms and the second contact being made between

a portion of one of said spring contact arms remote from its free end and one of said pins, said contacts being mounted in parallel and arranged in such a way that their closing periods are slightly staggered but partially superposed, the first contact always closing and opening before the second contact, so that no breaking extra-current takes place on the first contact.

4. In an electric timepiece according to claim 3, the two spring contact arms forming the legs of a U-shaped leaf and bearing against each other with their free ends.

5

10

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