United States Patent [19]

Schneiter

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[45] **Apr. 10, 1973**

[54] **ELECTRIC TIME-PIECE WITH CHRONOGRAPH INDICATOR**

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[30] **Foreign Application Priority Data**

Aug. 7, 1970 Switzerland.....11905/70

[52] **U.S. Cl.**.....**58/39.5,** 58/74

[51] **Int. Cl.**.....**G04f 3/06,** G04b 27/00

[58] **Field of Search**.....58/2, 23 R, 39.5, 58/74, 152 R, 153

[56] **References Cited**

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[57] **ABSTRACT**

An electric time-piece with a chronograph indicator, the chronograph indicating organ or organs of which can be put on and off by means of a controlling member operable manually, characterized by the fact that the circuit sustaining the resonator oscillations of said time-piece is designed so as to have a characteristic curve modifiable by adjustment, this adjustment being controlled by the control member for putting on and off the chronograph indicator, the whole being so arranged that said adjustment compensates for the extra energy consumed by the clockwork when the chronograph indicator is on and keeps the amplitude of the resonator oscillations unchanged.

8 Claims, 5 Drawing Figures

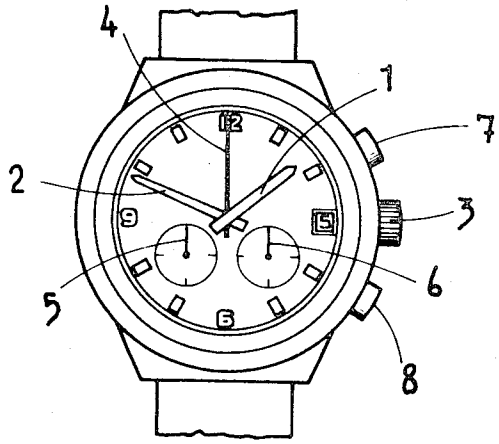
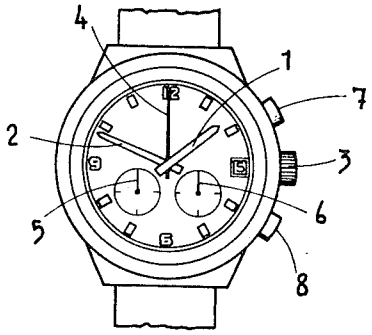


FIG. 1



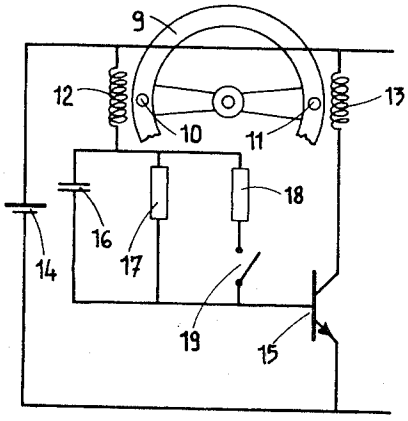


FIG. 2

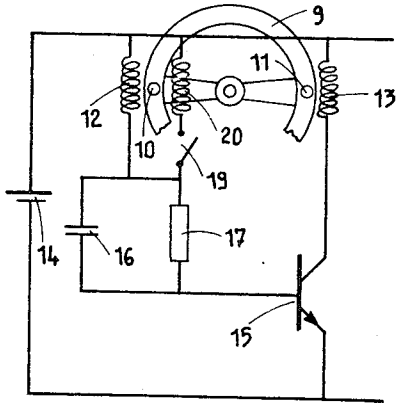


FIG. 3

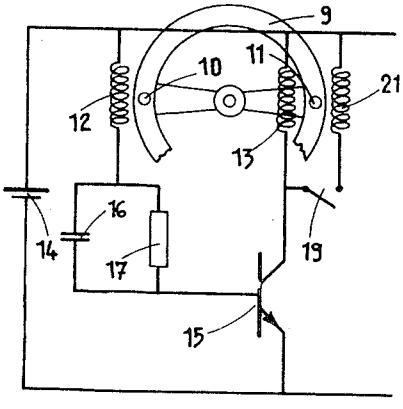


FIG. 4

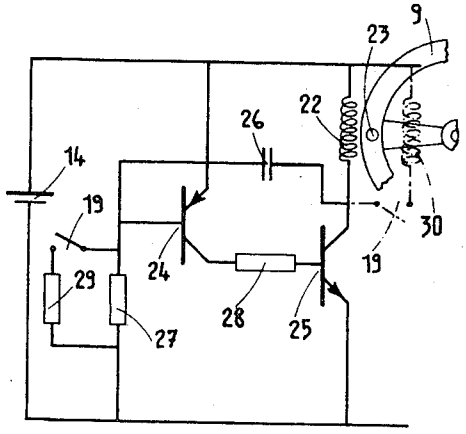


FIG. 5

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ELECTRIC TIME-PIECE WITH CHRONOGRAPH INDICATOR

The present invention relates to an electric time-piece with chronograph indicator, the chronograph indicating organ or organs of which can be put on and off by means of a control member which can be operated manually.

Electric time-pieces are very sensitive, as regards the steadiness of their running, to possible variations in the power consumed by the moving organs of the clockwork, this being valid even when the current supply is powerful enough to cope with a maximum of energy consumption. This sensitivity arises from the fact that the operational efficiency of the circuit sustaining the resonator oscillations, particularly the output of the transducer, is not 100 percent and from the fact that the stabilization factor of such circuits is not the ultimate. It results therefrom that to an additional pull overcome by the driving resonator corresponds a decrease in its oscillations amplitude which leads to a change in the running pace of the watch.

The object of the present invention is to furnish an electric time-piece with chronograph indicator which is practically insensitive to the variations in the energy consumed by the moving organs of the clockwork which occur when the chronograph indicator is put on and off.

This object is attained for the reason that the circuit sustaining the resonator oscillations of the time-piece according to the invention is designed so as to have a characteristic curve modifiable by adjustment, this adjustment being controlled by the control member designed for putting on and off the chronograph indicator, the whole being so that said adjustment compensates for the extra energy consumed by the clockwork when the chronograph indicator is on and keeps the amplitude of the resonator oscillations unchanged.

The drawing shows, by way of example, one particular embodiment of the object of the invention.

FIG. 1 is a plan view of an electric wristwatch with chronograph indicator.

FIG. 2 represents the circuit sustaining the oscillations of the driving resonator of the watch shown in FIG. 1, which resonator comprises a balance wheel, and

FIG. 3 to 5 represent three modifications of the electronic circuit for sustaining the oscillations of the driving balance wheel of an electric watch with chronograph indicator.

The watch represented on FIG. 1 comprises, besides the hour hand 1 and minute hand 2 which can be set right manually by means of a crown 3, a chronograph hand 4 as well as a minute-counter 5 and an hour-counter 6. A push-piece 7, operable manually, permits switching on and thereafter stop the chronograph hand 4, also causing the hands 5 and 6 to be driven intermittently, whereas a push-piece 8, also operable by hand, permits resetting said hands back to zero after they have been stopped.

The time-keeping element of this time-piece, acting simultaneously as a motor, comprises a balance wheel 9 carrying two permanent magnets 10 and 11 moving opposite two coils 12 and 13 respectively, said coils being the pick-up and the driving coil, respectively, and belonging to the circuit sustaining the oscillations of this

balance wheel. This circuit comprises a current source 14, constituted by an electric battery, supplying coil 13 with electric current by means of the emitter-collector circuit of a blocking transistor 15. The pick-up coil 12 is connected in the circuit controlling the operation of transistor 15, which circuit further comprises a time constant loop formed by capacitor 16 and resistor 17 connected in parallel.

This circuit comprises an additional resistor 18, parallel connected with the time constant loop 16–17, which can be switched on and off by means of switch 19. This switch is driven, through the medium of a mechanical device known per se, by the push-piece 7 used for putting on and off the chronograph indicator. The arrangement is such that, when the chronograph indicator is on, this switch is open whereas it is closed, when the chronograph indicator is off.

Switching on and off the additional resistor 18 alters the instant bias of the transistor 15 in such a manner that the effects of the additional force necessary for driving the chronograph hand 4 and, intermittently, hands 5 and 6, are connected by this bias change. It results therefrom that the amplitude of the oscillations of the balance wheel 9 remains constant, independently on the chronograph indicator being on or off, and that the running of the watch keeps thus unaffected by putting on the chronograph indicator.

As a modification, the switch 19 could be parallel connected with resistor 18, which would permit short-circuiting the latter.

In the modifications of the sustaining circuits of FIG. 3 to 5, the same reference numerals have been used to indicate the same elements as in the embodiment of FIG. 1 and 2.

In the modification of FIG. 3, the circuit comprises a second pick-up coil, indicated 20, connected in parallel with pick-up coil 12, and which can be switched on and off by a switch 19. The closing of this switch 19, which is controlled by push-piece 7 when the chronograph indicator is put on, alters the voltage induced in pick-up coil 12 when it is swept by the field of magnet 10, which results in the same compensating effect as in the first embodiment.

In the modification of FIG. 4, a second driving-coil, indicated 21, is parallel connected with driving-coil 13, the switch 19, in its circuit, allowing it to be put on and off. This additional driving coil 21 permits obtaining the compensating effect sought by changing the distributed force : Effectively, more current passes when the two coils 13 and 21 are working in parallel than when coil 13 works alone.

The circuit represented on FIG. 5 comprises only one coil 22 which acts as a pick-up as well as a driving coil, opposite which swings a magnet 23 carried by balance wheel 9. This circuit comprises two transistors 24 and 25, the first one being a controlling transistor and the second a blocking transistor. A time constant circuit is constituted by capacitor 26 and resistor 27, and a resistor 28 is connected on the line connecting the collector of transistor 24 and the base of transistor 25. The current source is indicated 14.

In this modification, an additional resistor 29 is connected in parallel with resistor 27, its associated circuit comprising the switch 19 controlled by the push-piece 7 of the chronograph indicator.

The action of resistor **29** is identical to that of resistor **18** of the first embodiment , but applied to the controlling transistor, however, instead of to the blocking transistor.

As another modification, and still in the case of the circuit of FIG. **5**, a second coil could also be added, as shown by dotted and dashed lines at **30**, in parallel with coil **22**.

Finally, the situation could happen wherein the whole sustaining circuit would be doubled, switch **19** being connected in the supply circuit of the second circuit. It would not be necessary, in this case, to add one or more permanent magnets to the balance wheel.

The present arrangement has the advantage of not only preserving a perfect isochronism of the resonator, which, incidentally, could be different from a balance wheel, but, furthermore, of allowing the watch to run on an amount of power just necessary for running normally, without having to take account of the extra power necessary for driving the additional indicator, wherefrom a saving in current consumption occurs.

What I claim is :

1. In an electric timepiece with a chronograph indicator, the chronograph indicating organ or organs of which can be put on and off by means of a control member operable manually, the combination of:

a sustaining circuit sustaining the resonator oscillations of the timepiece being designed to have a characteristic curve modifiable by an adjustment controlled by the control member designed for putting on and off the chronograph indicator,

the adjustment compensating for the extra energy consumed by the clockwork when the chronograph indicator is on and keeps the amplitude of the resonator oscillations unchanged.

2. In the timepiece as claimed in claim **1**, the sustaining circuit comprising at least one transistor, the circuit being provided with means for modifying the bias of the transistor.

3. In the timepiece as claimed in claim **2**, the bias modifying means comprising a resistor connected to and disconnected from the control circuit of the transistor.

4. In the timepiece as claimed in claim **1**, the sustaining circuit comprising a pick-up coil with the resonator producing, by induction, driving signals, the circuit being provided with means for modifying the voltage induced in the coil by the resonator.

5. In the timepiece as claimed in claim **4**, the voltage modifying means comprising a second pick-up coil selectively arranged in parallel connected with the first one or disconnected.

6. In the timepiece as claimed in claim **1**, the sustaining circuit comprising a driving coil to which the sustaining pulses produced by the resonator are sent, the circuit being provided with means for modifying the voltage of the sustaining pulses.

7. In the timepiece as claimed in claim **6**, the voltage modifying means comprising a second driving coil selectively arranged in parallel connected with the first one or disconnected.

8. In the timepiece as claimed in claim **1**, including a second sustaining circuit arranged in a manner wherein it can be alternately connected to or disconnected from the first circuit.

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