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METHOD FOR CORRECTING THE ANISOCHRONISM OF A TIMEPIECE, AND THE TIMEPIECE OBTAINED BY THE APPLICATION OF THIS METHOD

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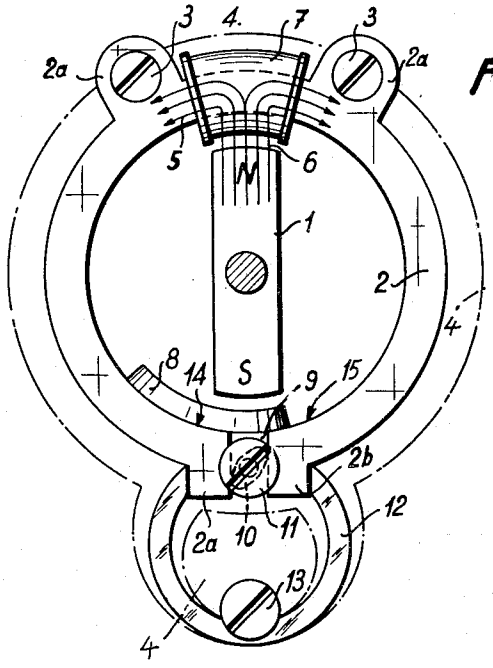



Fig. 1

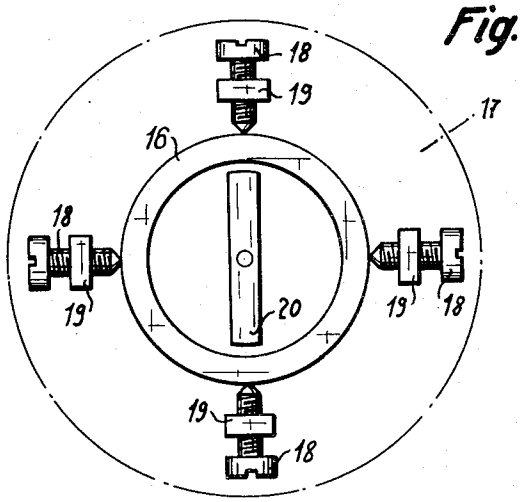



Fig. 2

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# METHOD FOR CORRECTING THE ANISOCHRONISM OF A TIMEPIECE, AND THE TIMEPIECE OBTAINED BY THE APPLICATION OF THIS METHOD

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6 Claims. (Cl. 310—36)

The present invention relates to a method of at least partially correcting the anisochronism of the electromagnetically maintained oscillating regulator member of a timepiece of the type forming the subject of Patent No. 2,946,940, Beyner et al., issued July 26, 1960, that is to say, a timepiece in which the regulator member is rigid with a magnet oscillating in the neighbourhood of a ring and producing by induction, in a pick-up winding, an impulse signal controlling the feed of a driving winding, at the rate of one driving impulse per oscillation of the balance wheel.

The invention also concerns the timepiece obtained by the application of this method.

The regulator member of a timepiece, whether it be electromagnetically or mechanically maintained, always has residual anisochronism, regardless of the measures applied to render it isochronous. The object of the present invention is further to reduce this residual anisochronism, or even to eliminate it, by creating by means of an action on the device by which the regulator is maintained, a directed cause of anisochronism such as to compensate at least partially for the aforesaid residual anisochronism.

The method according to the invention is characterised by the fact that the cause of directed anisochronism is created by disposing the ring and the oscillating magnet slightly eccentrically in relation to one another.

The timepiece according to the present invention is characterised by the fact that the ring and the oscillating magnet are disposed slightly eccentrically in relation to one another.

The accompanying drawings, in which only the parts necessary for an understanding of the invention are shown, illustrate by way of example two constructional forms of the subject of the invention.

FIGURE 1 is a plan view of a detail of a first constructional form of a timepiece, and

FIGURE 2 is a plan view of a detail of a second constructional form of a timepiece.

In the first constructional form, the balance wheel of the timepiece consists of a magnetised bar **1** oscillating within a ring **2**, in the plane of the latter. The magnet is subjected to the action of a regulating hair spring (not shown). The ring **2** has two lugs **2***a*, through which there extend fixing screws **3** engaging in the plate **4** of the movement frame. The ring is intended to divide the magnetic flux of the magnet **1** into two partial fluxes **5** and **6**.

The ring **2** supports a pick-up winding **7** and driving winding **8** of pancake type, situated in the air gap. During the travel of the north pole of the magnet past the pick-up winding **7**, a current is induced in this winding and is transmitted through an amplifier circuit (not shown) to the driving winding **8**. The operation thereof is described in detail in Patent No. 2,946,940, Beyner et al.

The ring **2** is open at **9**, at a point diametrically opposite the pick-up winding **7**. A cam **10** rigid with a slotted control head **11** is pivotally mounted on the frame of the movement, between the two ends **2***a* and **2***b* of the ring. A spring **12** in the form of an open ring, fixed to the movement plate **4** by a screw **13**, acts on these



ends of the ring so as to maintain them against the cam **10**. Owing to this arrangement, it is possible, by manipulating the control head **11**, to open or close the ring to a variable extent, thus creating between the ring and the oscillating magnet an eccentricity by which the oscillations of the magnet are magnetically affected. The anisochronism thus introduced into the oscillating system, and which is adjustable, can at least partially compensate for the causes of anisochronism present in any oscillating regulator (balance wheel-hair spring system) of a timepiece.

Thus, by turning the eccentric **10** in such manner as to reduce the width of the slot **9**, the magnet **1** is moved towards the surfaces of the ring designated **14** and **15**, whereby the small arcs of the oscillating magnet are advanced. On the other hand, when the width of the slot **9** is increased, the surfaces **14** and **15** of the ring are moved away from the magnet **1**, whereby the small arcs of the magnet are retarded.

The width of the slots in the ring may be adjusted by means other than the cam **10** described and illustrated. Thus, it is possible to use, for example, a wedge-shaped spacer member introduced between the ends of the ring and shifted by means of an adjustment screw.

The slot **9** in the ring has, in addition, the effect of reducing one of the partial magnetic fluxes of the magnet in favour of the other when the magnet occupies a position differing from its position of equilibrium as illustrated in the drawing, whereby the quality of the signal induced in the pick-up winding **7** is improved (see Patent No. 2,946,940, Beyner et al. In order that this effect may be retained, the cam **10** and the spring **12** will consist of a non-magnetic material.

In the constructional form of FIGURE 2, the ring designated **16** is maintained in position on the plate of the diagrammatically illustrated movement **17** by four screws **18** disposed at 90° with respect to one another and adapted to be screwed in studs **19** fixed to the plate and bearing radially against the ring. The balance wheel also consists of a bipolar magnet, here designated **20**, which rotates within the ring, in the plane of the latter. By screwing or unscrewing the screws **18** to a variable extent, it is possible to produce in all directions an eccentricity between the ring **16** and the magnet **20**, which eccentricity is of adjustable value. This eccentricity and its direction create by magnetic means an anisochronism of the oscillating member, whereby it is possible, as in the first constructional form, to compensate for the anisochronism of the adjusting system of the timepiece.

The invention is not limited to the constructional forms described and illustrated. Thus, the oscillating magnet need not itself constitute the regulating balance wheel, but may be distinct therefrom. The magnet and the balance wheel will then be rotatable with one another.

What I claim is:

1. In a timepiece having an electromagnetically maintained regulator of the oscillatory type inherently prone to anisochronism, which regulator comprises an oscillatory permanent field magnet, and a ring of material of high magnetic permeability forming air gaps with the poles of the magnet and so forming flux paths with said magnet as to divide the flux of the magnet into a number of partial fluxes equal to the number of poles of the magnet, the feature that said ring and the oscillatory magnet are disposed slightly eccentrically in relation to each other so as to produce magnetically as the result of the eccentricity and oscillation of said magnet, anisochronism in the regulator at least partially compensating for the anisochronism to which the regulator is inherently prone.

2. In a timepiece having an electromagnetically maintained regulator of the oscillatory type inherently prone

to anisochronism, which regulator comprises an oscillatory permanent field magnet, and a ring of material of high magnetic permeability forming air gaps with the poles of the magnet and so forming flux paths with said magnet as to divide the flux of the magnet into a number of partial fluxes equal to the number of poles of the magnet, the feature that said ring has a radial air gap between adjacent ends thereof and is so disposed in forming the air gap as to introduce eccentricity between itself and the oscillatory magnet for the magnet and ring to produce magnetically as the result of the eccentricity and oscillation of said magnet, anisochronism in the regulator at least partially compensating for the anisochronism to which the regulator is inherently prone.

3. In a timepiece having an electromagnetically maintained regulator of the oscillatory type inherently prone to anisochronism, which regulator comprises an oscillatory permanent field magnet, and a ring of material of high magnetic permeability forming air gaps with the poles of the magnet and so forming flux paths with said magnet as to divide the flux of the magnet into a number of partial fluxes equal to the number of poles of the magnet, the feature that said ring has a radial air gap between adjacent ends thereof, and said regulator includes adjusting means engaging said adjacent ends of the ring for the positions occupied by said ends relative to each other to be altered to produce slight eccentricity between said ring and the oscillatory magnet and for said ring and magnet to create magnetically as the result of the eccentricity and oscillation of said magnet, anisochronism in the regulator at least partially compensating for the anisochronism to which the regulator is inherently prone.

4. In a timepiece having an electromagnetically maintained regulator of the oscillatory type inherently prone to anisochronism, which regulator comprises an oscillatory permanent field magnet, and a ring of material of high magnetic permeability forming air gaps with the poles of the magnet and so forming flux paths with said magnet as to divide the flux of the magnet into a number of partial fluxes equal to the number of poles of the magnet, the feature that said ring has a radial air gap between adjacent ends thereof, and said regulator includes a rotatably mounted cam disposed in the air gap between said adjacent ends of the ring, said cam operably engaging the ends of the ring and on rotation altering the dimension of said gap between said ends to produce slight eccentricity between said ring and the oscillatory magnet and for said ring and magnet to create magnetically as the result of the eccentricity and oscillation of said magnet, anisochronism in the regulator at least partially compensating for the anisochronism to which the regulator is inherently prone.

5. In a timepiece having an electromagnetically maintained regulator of the oscillatory type inherently prone to anisochronism, which regulator comprises an oscillatory permanent field magnet, and a ring of material of high magnetic permeability forming air gaps with the poles of the magnet and so forming flux paths with said magnet as to divide the flux of the magnet into a number of partial fluxes equal to the number of poles of the magnet, the feature that said ring has a radial air gap between adjacent ends thereof, said regulator includes a rotatably mounted cam disposed in the air gap between said adjacent ends of the ring, and resilient means acting upon said ends of the ring to maintain said ends against said cam, said cam on rotation altering the dimension of said gap between said ends to produce slight eccentricity between said ring and the oscillatory magnet and for said ring and magnet to create magnetically as the result of the eccentricity and oscillation of said magnet, anisochronism in the regulator at least partially compensating for the anisochronism to which the regulator is inherently prone.

6. In a timepiece having an electromagnetically maintained regulator of the oscillatory type inherently prone to anisochronism, which regulator comprises an oscillatory permanent field magnet, and a ring of material of high magnetic permeability forming air gaps with the poles of the magnet and so forming flux paths with said magnet as to divide the flux of the magnet into a number of partial fluxes equal to the number of poles of the magnet, the feature that said ring is mounted on a frame, said frame supporting screws which oppose each other and axially extend generally radially of the ring into contact with the circumference of the ring for displacing the ring in the plane of the ring to produce slight eccentricity between said ring and the oscillatory magnet and for said ring and magnet to create magnetically as the result of the eccentricity and oscillation of said magnet, anisochronism in the regulator at least partially compensating for the anisochronism to which the regulator is inherently prone.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 2,941,417 | Junghans et al. | June 21, 1960 |
| 2,946,940 | Beyner et al. | July 26, 1960 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 569,483 | Canada | Jan. 27, 1959 |