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DRAWINGS ATTACHED

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(54) ELECTROMAGNETIC MICROMOTOR FOR AN ELECTRONIC WATCH

(71) We, COMPAGNIE DES MONTRES LONGINES, FRANCILLON S.A. of 2610 Saint-Imier, Switzerland and BERNARD GOLAY S.A. of 2 Croix-Rouge, 1000 Lausanne, Switzerland; both Swiss body corporates, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

According to the present invention there is provided an electromagnetic vibratory micromotor in an electronic watch, which in operation vibrates at an acoustical frequency, the vibration being sustained and controlled by a very stable electronic oscillator, and comprising an elastic member supporting an oscillatory mass member carrying an impulse pawl cooperating with a ratchet wheel arranged to drive the gear-train of the watch, a stop pawl cooperating with the ratchet wheel and being mounted on the frame of the micromotor, characterized in that the ratchet wheel and the said pawls are situated in a common plane perpendicular to the plane of the watch movement and that an inclined mirror fixed in the watch renders possible the observation of the motion of the said ratchet wheel and of the said pawls along an optic axis substantially perpendicular to the plane of the watch movement.

The accompanying drawing illustrates, by way of example, an embodiment of the invention.

The single figure is a perspective view of said embodiment.

The micromotor illustrated in the drawing includes a U-shaped frame 1 the base 1*a* of which is rather massive, whereas its legs 1*b* and 1*c* are thinner and therefore have a certain elasticity in a plane parallel to the pillar-plate 25. The micromotor additionally includes a plane torsion blade 2, perpendicular to the plane of the watch, the longitudinal axis of said blade being parallel to the plane of the watch. The blade 2 is resilient and is the elastic member of the motor. It is embedded at both its ends in the legs 1*b* and 1*c* of the frame 1 and carries in the middle thereof a mass member, which is formed by a rigid bar 3, extending on both sides of the torsion blade 2. At the ends of the bar 3 are respectively fixed a coil 4 and a counterweight 5 in such a manner that a static equilibrium is obtained about the axis of the torsion blade 2. The coil 4 is electromagnetically connected with a stationary magnetic circuit consisting of a pair of permanent magnets 6 and two pairs of polar pieces 7, 8. This electromagnetic device is driven by a very stable oscillator, such as one including a quartz resonator.

The legs 1*b* and 1*c* of the frame 1, in which are embedded the ends of the torsion blade 2, guarantee a strong rigidity in the direction of rotation of the mass or bar 3, but allow a longitudinal displacement of the embedding points, which displacement is caused by the shortening of the torsion blade 2 during its oscillation.

The bar 3 carries an impulse pawl 9 cooperating with a ratchet wheel 10 the shaft 11 of which is pivoted between two small plates 12; the shaft 11 carries a worm 13 which is in mesh with the first wheel 14 of the gear-train of the watch. The reference numeral 15 denotes the train-bridge and 25 the pillar-plate of the watch, the frame 1 being mounted on said pillar-plate 25. Thus, the micromotor forms a sub-assembly of the watch, situated at least partially above the gear-train of the watch.

The leg 1*b* of the frame 1 has an inner flange 16 above which is placed a plate 17 made integral with a blade 18 which is fixed to the base 1*a* of the frame 1. The blade 18 is resilient in two planes which are respectively parallel and perpendicular to the upper face of the pillar-plate 25 and tends to lift the plate 17 away from the flange 16, but this is prevented by a screw 19 screwed in the

flange 16 and bearing on the upper face of the plate 17, said screw 19 permitting the parts 16 and 17 to be spaced from each other at an adjustable distance. An eccentric 20, screwed into the flange 16 and whose head is accommodated within an elongated opening 21 of the plate 17, enables the user to slightly displace the plate 17 in a direction transverse to the bar 3. An extension 22 of the plate 17 carries a stop pawl 23 cooperating with the ratchet wheel 10. By turning the screw 19, it is possible to adjust the position of the stop pawl 23, and by means of the eccentric 20, it is possible to adjust the pressure of this pawl 23.

A mirror 24, consisting of a prism, is arranged in the vicinity of the ratchet wheel 10 and its active surface is inclined at 45° with respect to the plane of the watch movement. By means of this mirror 24 it is possible to observe the motion of the ratchet wheel 10 and of the pawls 9 and 23, which are situated in a plane perpendicular to the plane of the watch movement along an optic axis substantially perpendicular to the plane of the watch movement. The provision of the mirror 24 facilitates adjustment of the stop pawl 23 and permits easy checking of the operation.

The operation of the micromotor as illustrated is easily understood with the help of the foregoing description. When the stable oscillator drives the electromagnetic device 4, 6, 7, 8, the bar 3 begins to oscillate at an acoustical frequency determined by its mass and the stiffness of the blade 2. The impulse pawl 9, fixed to the bar 3, advances the ratchet wheel 10 step by step and the latter, through the intermediary of the worm 13, drives the wheel 14 of the gear-train of the watch.

Other aspects of the invention form the subject matter of co-pending application No. 25451/70, Serial No. 1,295,105.

WHAT WE CLAIM IS:—

1. An electromagnetic vibratory micromotor in an electronic watch, which in operation vibrates at an acoustical frequency the vibration being sustained and controlled by a very stable electronic oscillator, and comprising an elastic member supporting an oscillatory mass member carrying an impulse pawl cooperating with a ratchet wheel arranged to drive the gear-train of the watch, a stop pawl cooperating with the ratchet wheel and being mounted on the frame of the micromotor, characterized in that the ratchet wheel and the said pawls are situated in a common plane perpendicular to the plane of the watch movement and that an inclined mirror fixed in the watch renders possible the observation of the motion of the said ratchet wheel and of the said pawls along an optic axis substantially perpendicular to the plane of the watch movement.

2. A micromotor according to claim 1, wherein the said mirror consists of a prism.

3. A micromotor according to claim 1, wherein the active surface of the said mirror is inclined at 45° with respect to the plane of the watch movement.

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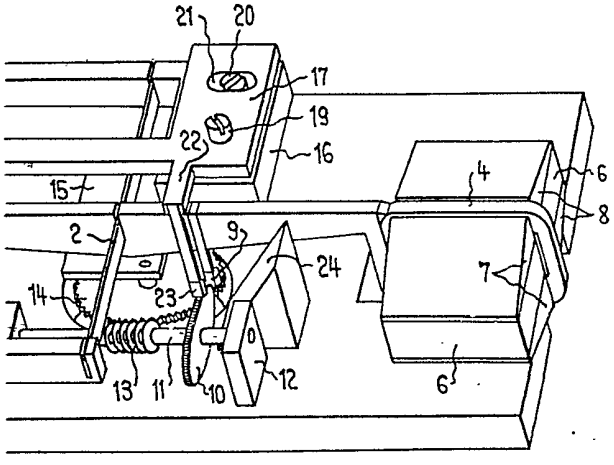
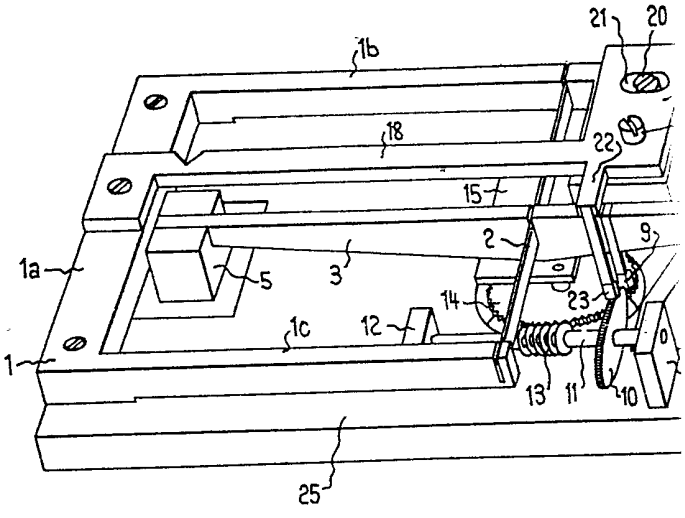
1295104 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

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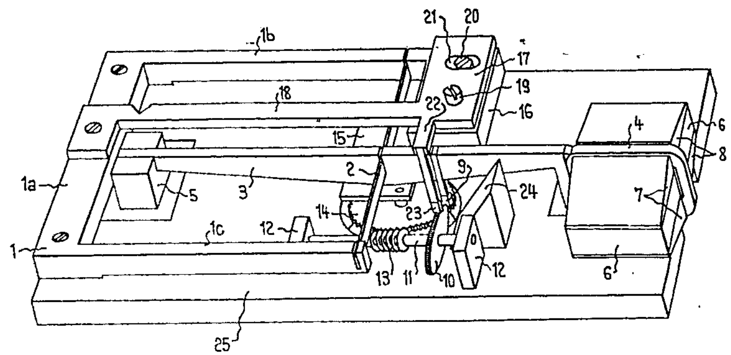
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