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3,137,992

MECHANICAL OSCILLATOR CHIEFLY FOR ELECTRONIC TIMEPIECES

Filed March 9, 1962

FIG. 1

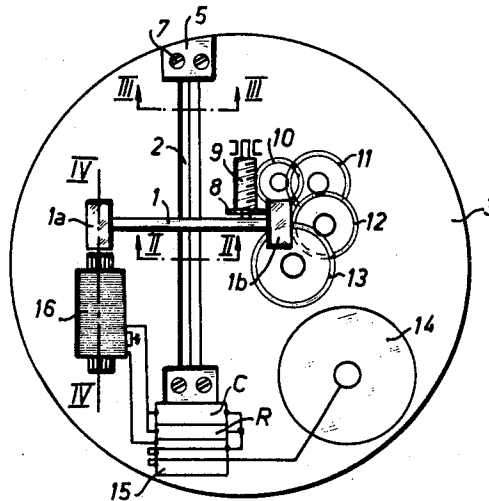


FIG. 2

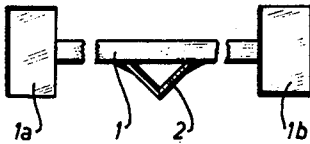


FIG. 3

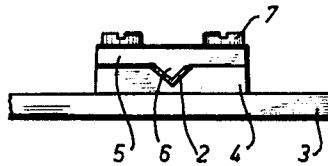


FIG. 4

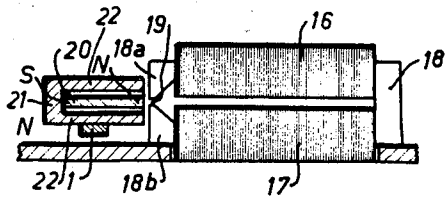
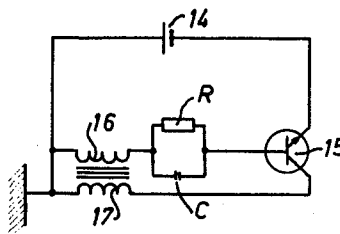


FIG. 5



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1 Claim. (Cl. 58—23)

The regulating parts for time-pieces are generally constituted by a pendulum or a spiral balance spring oscillating at a comparatively low frequency and requiring a large amount of energy. Some electronic watches are provided with a tuning fork of which the much higher frequency may rise up to 500 cycles.

It has also been proposed to resort to arrangements oscillating at mean frequencies ranging between about 30 and 60 cycles and including a torsion spring held fast at least at one of its ends and carrying a mass adapted to rock round said spring. To this end, springs have been used hitherto having different cross-sectional shapes such as that of a circle or of a cross. In this latter case, an excellent resistance against bending is obtained but the machining and in particular the cutting of the cross-section is a delicate matter which is generally not sufficiently accurate and leads to an objectionable internal straining. In order to cut out said drawbacks, it has already been proposed to resort to a system of springs constituted by several flat strips, the planes of which meet one another along the oscillatory axis of the mass. This arrangement requires however the use of several blades and of comparatively intricate fitting systems and leads also to a difficult adjustment.

The present invention has for its object a mechanical oscillator, chiefly for electronic time-pieces, said oscillator including a torsion spring held fast at least at one of its ends and carrying a mass adapted to rock round said spring. Said spring which does not show the above mentioned drawbacks, is constituted by a single blade of a generally elongated shape extending perpendicularly to the axis of rotation of the mass, said blade being bent throughout its length so as to show cross-sectionally the shape of a V.

The accompanying drawing illustrates by way of example an advantageous embodiment of my invention. In said drawings:

FIG. 1 is a general plan view of the arrangement,

FIGS. 2, 3 and 4 are partial cross-sections thereof, respectively through lines II—II and III—III of FIG. 4,

FIG. 5 is a wiring diagram of the electric movement maintaining system.

The oscillator illustrated includes a transverse arm 1 welded to a torsion spring element 2 secured at both ends to the plate 3 of a time-piece. Said arm 1 may of course be secured to the spring in various ways, for instance through gluing or mechanical securing. The spring blade 2 has a constant thickness and a generally rectangular cross-section is bent so that its cross-section is in the shape of a V or V-shaped throughout the length of the spring blade which extends perpendicularly to the arm 1. Said V-shaped cross-section may be obtained in a particularly easy manner and allows giving the finished spring an excellent resistance against bending while retaining a comparatively reduced resistance against twisting. Experiments made have shown that it is an easy matter to obtain a ratio equal to 7,500 between the torsional and bending constants. The two ends of the arm 1 are furthermore weighted each by the symmetrical masses 1a and 1b.

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The two ends of the spring are each fitted rigidly in the plate 3 so as to define accurately the operative length of said spring. The fitting means include as shown in FIG. 3, on the one hand, a support 4 rigid with the plate and provided with a V-shaped housing matching the shape of the springs and furthermore, a bridge member 5 provided with a downwardly facing V-shaped projection 6. Screws 7 allow clamping the bridge member over its support 4. As a modification, it is also possible to glue or else to weld the spring to the plate, for instance through electric or supersonic means.

The arm 1 is provided with a catch system which is not illustrated and which is adapted to drive a wheel 8 rigid with a worm 9. The latter controls the mechanism of the watch which mechanism includes an intermediate wheel 10, an eccentric seconds gear 11, a third gear 12 and lastly a center wheel 13. The motion work controlling the hands has not been illustrated.

The worm 9 allows shifting the plane of the mechanism and it is very suitable for cooperation with time-setting means since it transmits the movements of the oscillator to the hands whereas, in the opposite direction, it acts as a catch. The arm is constrained to oscillate under the action of an electronic system including a control supply 14 feeding a transistor 15 in the control circuit of which is inserted a collecting winding 16 while its power circuit includes a driving winding 17. The two windings are carried by a U-shaped armature 18 provided at its outer end with a very narrow gap 19 facing one of the poles of the magnetic bar 20. Said bar is carried inside a U-shaped magnetic member 21 which is secured to the arm 1. The legs 22 of said member are separated from the bar 20 by a layer of non-magnetic material. When the magnet moves towards one end 18a of the armature, the flux produced by it induces in the winding 16 a pulse which releases the transistor; the latter allows then current to pass through the winding 17 and the flux appearing consequently inside the gap 19 urges the magnet into movement as the latter moves thereafter towards the end 18b of the armature. The oscillation of the whole arrangement has a frequency which may reach 30 to 60 cycles and is extremely uniform.

What I claim is:

In a timepiece comprising a plate and a gear train, an electro-mechanical oscillator for uniformly driving and regulating the driving of said gear train, comprising an elongated torsion spring element twistable about its longitudinal axis, clamping means on opposite sides of said spring element securing opposite ends of said spring element stationarily to said plate, said spring having a constant thickness and a V-shaped section along its full length intermediate said securing means, an arm secured to said spring element intermediate said opposite ends of said spring element and extending transversely of said spring element and oscillatable about the longitudinal axis of said spring element, said arm being secured across the open side of said V, means including an electronic circuit for oscillating said arm about the longitudinal axis of said spring element and causing a torsional twisting of said spring element and means for imparting drive to said gear train from said oscillator during oscillatory motion thereof.

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