Aug. 10, 1965 G. VOSSELER 3,200,270

ELECTROMECHANICAL DRIVING SYSTEM FOR TIME-PIECE GEARING

Filed Dec. 21, 1962

FIG. 1

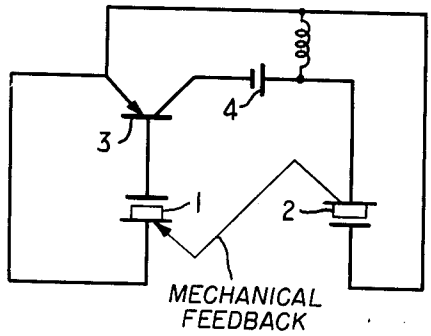


FIG. 2

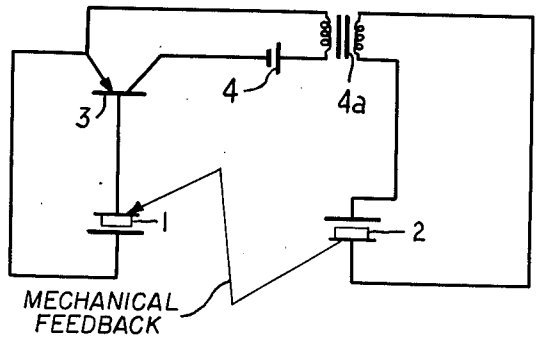
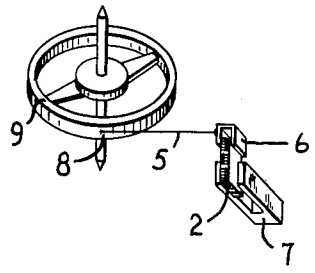


FIG. 3



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ELECTROMECHANICAL DRIVING SYSTEM FOR TIME-PIECE GEARING

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Various types of time-pieces are known wherein the time base is constituted by an oscillator the oscillations of which are maintained through electronic means. The oscillators control an arrangement for driving a gear constituted for instance by a catch or by a synchronous motor.

When the oscillator operates under comparatively low frequency conditions, it is possible to resort to a purely mechanical driving sustem such as a catch-actuated mechanism and this is in particular the case for certain time-pieces where the time base is constituted by a tuning fork oscillating at a frequency of 100 to 200 cycles and which is provided with a catch cooperating with a finely toothed ratchet wheel.

In contradistinction, when the oscillation reaches higher frequency conditions as is in particular the case with quartz oscillators, it is necessary to resort either to electrical driving means or to frequency dividers. The latter are however of a comparatively intricate structure and their bulk is so large that they cannot be used in wrist watches.

My invention has for its object a mechanical driving system for a time-piece gear under the action of an oscillator defining the time base of said time-piece and operating at a comparatively high frequency.

According to my invention, I resort to an oscillating member controlled by said oscillator and carrying a rod the end of which engages the periphery of a driving gear under a pressure and along a direction such that, when said member oscillates at its resonance frequency, the rod undulates in response to the oscillations and urges the gear forwards and drives it rotationally.

I have illustrated, by way of example, in the accompanying drawings, a preferred embodiment of my invention. In the drawings:

FIG. 1 is a wiring diagram illustrating the operation of a quartz oscillator and

FIG. 2 is a modification of the embodiment of FIG. 1.

FIG. 3 is a perspective view of the mechanical parts of an embodiment of the invention.

The oscillator illustrated in FIG. 1 forms a time base for a time piece. It includes two quartz crystals **1** and **2**, a transistor **3** and a supply of electrical energy **4**. The quartz crystal **1** acts as the collecting member and the signal produced by its relases the transistor **3** which then allows current to pass through the second quartz crystal **2**. The latter begins vibrating and transmits its vibrations to the quartz crystal **1** through as a mechanical feedback and also acts as a driving member as hereinafter explained. The feedback between the two quartz crystals cannot be obtained in a favorable manner unless the transmission of the mechanical vibrations is undisturbed and if the two quartz crystals are disposed sufficiently near one another then maximum efficiency is obtained within the range of resonance frequencies of the quartz crystals.

In the modification illustrated in FIG. 2, electric coupling between the two quartz crystals is obtained through the agency of a small transformer **4***a* which allows a certain reduction in the frequency of oscillation of one of quartz crystals with reference to the other. According to further modifications which are not illustrated, it

is, of course, possible to resort to other types of oscillators.

The driving system includes a fine rod **5** (FIG. 3) glued by means of a drop of shellac to a strap **6** secured to the driving quartz **2** which is, in its turn, fitted inside a support **7**. The end **8** of the rod is applied under a pressure of a predetermined value and along a predetermined direction against the smooth periphery of the driving ratchet wheel **9** forming the first gear of the gearing of the time-piece. When the oscillator reaches its resonance frequency, the quartz **2** vibrates and drives the rod **5** of which the end has imparted thereto a corresponding axial shifting the frequency of which may range for instance between 1 kilocycle and 1 megacycle. The presusre exerted on the rod and the angular setting thereof with reference to the ratchet wheel are suitably selected so that the end of the rod may urge forwardly the ratchet wheel which starts revolving.

Experience has shown that the operation of such an arrangement is extremely uniform by reason of its lack of sensitivity in the presence of any modification in the position of the watch, while the wear of the rod is practically zero since the rod does not rub and acts merely on the wheel through a series of short axial shocks of a reduced sensitivity. Furthermore, the structure is particularly simple and its execution is cheap since it requires no winding and no magnet as in the case of corresponding electrical arrangements, nor does it require any spring as in the case of all known mechanical arrangements. Lastly, it allows transforming directly through simple mechanical means, oscillating movements of a comparatively high frequency ranging between 1 kylocycle and 1 megacycle or thereabouts.

Obviously, my invention is not limited to the arrangements described and illustrated and, in particular, the rod may be fitted on an oscillating element which is different from a quartz crystal, while the oscillators may also be of a different type.

What I claim is:

1. Apparatus for driving a timepiece having a drive ratchet wheel said apparatus comprising, an electromechanical oscillator comprising at least one crystal for establishing a time base, a pawl comprising on undulatable thin rod having a free end and an opposite end portion fastened to said crystal driven undulatingly by said crystal to a bent condition and an extended condition, said free end being disposed to engage said drive ratchet wheel on the periphery thereof and drive said ratchet wheel by undulations of said thin rod and subsequent extensions thereof.

2. Apparatus according to claim **1**, in which said thin rod is dimensioned in length and thickness to oscillate at a lower harmonic of the frequency of said crystal oscillator and the amplitude of the undulations of said thin rod have a greater amplitude than the mechanical vibrations of said crystal.

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