Oct. 6, 1953 H. STEIGER 2,654,214

MECHANICAL MOTION REGULATOR FOR CLOCKWORKS, WATCH MOVEMENTS, AND THE LIKE

Filed Nov. 21, 1950

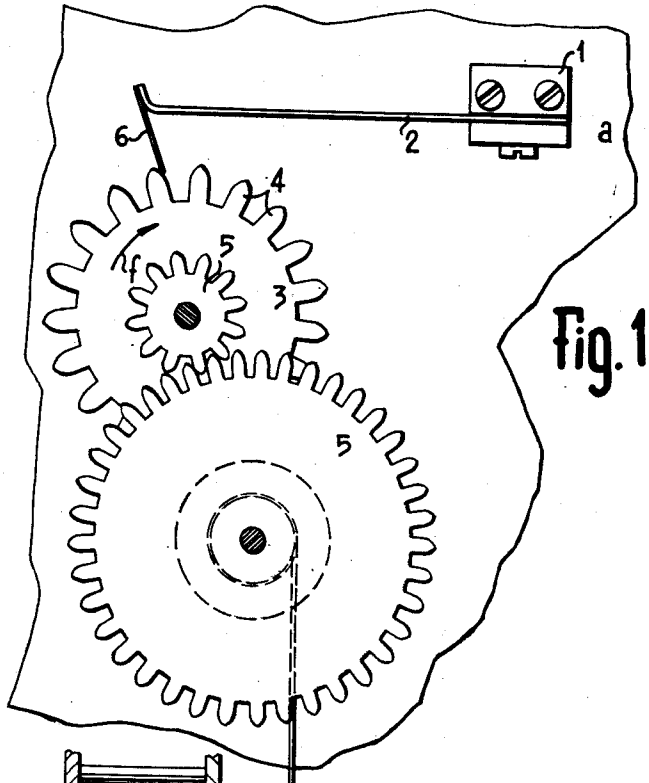


Fig. 1

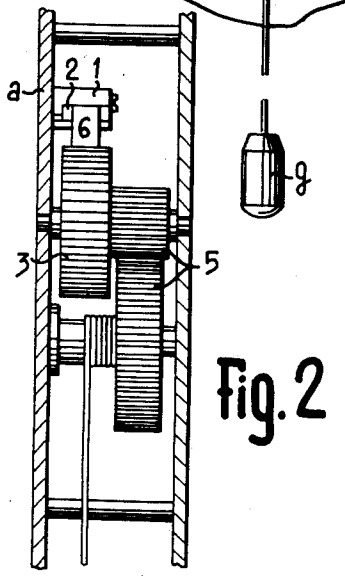


Fig. 2

Inventor
Hermann Steiger
By Young, Emery & Thompson
Atty's.

Patented Oct. 6, 1953

2,654,214

UNITED STATES PATENT OFFICE

2,654,214

MECHANICAL MOTION REGULATOR FOR CLOCKWORKS, WATCH MOVEMENTS, AND THE LIKE

Hermann Steiger, Geneva, Switzerland

Application November 21, 1950, Serial No. 196,745
In Switzerland May 12, 1950

5 Claims. (Cl. 58—116)

1

The present invention applies practically and in a new manner the isochronism of the oscillations of a one-sided fixed swing leaf spring (reed) with the object of keeping the constancy of the running of watch movements with main springs and the like.

The mechanical motion regulators hitherto existing, which also utilize the oscillations of a leaf spring in correlative action with a toothed motion wheel, are affected with defects insofar as their oscillations are influenced in a large way by the value of the torque imposed to a given embodiment of clockwork resulting in perturbation of the isochronism and the accuracy of movement of said clockwork. A further disadvantage of the existing motion regulators of this kind is the considerable friction which occurs between the motion wheel and the leaf spring, and its display of noises.

The well known oscillating leaf spring or reed of the Hipp regulator executes an oscillation of which the two half-periods are not equal because the contact between said reed and the escape wheel is hard. In fact this contact is only damped by means of a thin layer of air which is inefficient so that considerable friction occurs during the exchange of force between said escape wheel and said reed. Consequently the contact between the escape wheel is too hard and too long so that the second half-period of the oscillation of the reed of the Hipp regulator is disturbed and it follows that the time of this second half-period is always shorter than the time of the first period. Furthermore the reed of the Hipp regulator gives a loud noise and breaks after a short time of running. The rupture takes place on the point of fixation of the reed.

These disadvantages have been removed with the present invention by means of interposing an elastic member between the escape wheel and the said leaf spring or reed, which transmits elastically the force exchanged periodically between them; and furthermore through the fact that the leaf spring after having received an impulse on passing through the zero position makes a whole and undisturbed oscillatory movement having two equal half-periods, before it gets, near the zero position again into contact with the escape wheel through the interposed member, delaying the rotation of the escape wheel, on one side, and getting from the escape wheel a new impulse, on the other side.

The annexed drawing shows schematically and by way of example an embodiment of the mechanical regulator which excels in its simplicity

2

and which proved its practical utility on experiments made.

Fig. 1 is a front view of the motion regulator and Fig. 2 is a side view of the device.

In a block 1 fixed on a mounting plate *a* of the clockwork is inserted one end of a swing leaf spring 2 made of flat spring stock, whose elasticity agrees with the motional strength of the clockwork. Said leaf spring bears on its other end an interposing member 6 which consists also of spring stock whose elasticity is however in a certain proportion increased to that of the leaf spring 2.

The latter forms together with the interposing member an angle *b*, whose sides lie in the plane of the escape wheel 3 which is provided with teeth 4 disposed at regular intervals on its circumference. In the zero or neutral position of the leaf spring 2 the free end of the interposing member 6 protrudes slightly in the gap between the teeth 4 of the escape wheel 3.

As soon as the torque imparted by the weight *g* becomes effective, the escape wheel 3 driven by the gears 5 moves in the direction marked by arrow *f*. Consequently the free end of the interposing member 6 receives an impulse from one of the teeth 4, which is transmitted elastically on the swinging leaf spring 2, which latter is thus excited automatically. Because of the oscillation of the leaf spring 2 the interposing member 6 sets the tooth 4 free, whereupon the escape wheel 3 turns unopposed in the direction of the arrow *f*. In the meantime the leaf spring 2 carries out together with the interposing member 6 mounted on its end, a complete oscillation in the plane of the escape wheel 3. The amplitude of said elastic oscillation is a function of the force of the impulse imparted. Further the oscillation being free the two half periods of said oscillation of said leaf spring 2 are equal one another. A full oscillation being completed the free end of said interposing member 6 gets again, shortly before said leaf spring 2 passes through its zero position, into elastic contact with the following tooth 4 of the escape wheel 3. Thus there occurs a new exchange of force between said motion wheel on said swinging or elastic oscillating system constituted by said interposing member mounted on the free end of said leaf spring whereby on the one hand the speed of rotation of the escape wheel is decreased and on the other hand the leaf spring 2 receives a new impulse. Due to the elasticity of the interposing member 6 the exchange of force will be carried out without noise or damping of the oscillat-

ing movement of the leaf spring. Accordingly this cycle of operations goes on in always steady time intervals, the two half-periods of each oscillation of said oscillating movement of said leaf spring remaining equal one to the other independently of the variations of the torque imparted to said escape wheel and which can occur in a given embodiment of clockwork.

Practical tests have proved that a variation of the weight from 1 to 2 is unable to effect a variation in the time intervals between two succeeding impulses i. e. the velocity of the escape wheel remains always exactly the same. But such a variation of the weight effects a much greater variation of the torque imparted to the escape wheel than the greatest variation which can in practice occur for a given embodiment in the torque imparted to the escape wheel.

These practical tests have shown, that the mechanical motion regulator described runs noiselessly. Consequently the contact between the escape wheel and the plate spring must be very soft so that the friction which occurs during the exchange of force is negligible and does not disturb the oscillatory movement of the leaf spring, whereby the two half-periods of an oscillation are equal one to another.

As in the case of the reed of the Hipp regulator the teeth 4 and the plate spring should not be lubricated.

Such a motion regulator was run permanently during a period of eight months without any error or any wear. This is proof of the great superiority of the described motion regulation over the Hipp device.

It is clear that in another embodiment of the motion regulator described hereabove, the torque could be imparted to the escape wheel by a clock spring.

I claim:

1. A mechanical motion regulator for clockworks, watch movements, and the like, comprising a mounting plate, a toothed escape wheel rotatably mounted on said plate, an oscillating leaf spring mounted on said plate, an elastic interposing member on the free end of said leaf spring, the elasticity of said interposing member being greater than that of the leaf spring, said leaf spring being positioned in spaced relation to the periphery of said escape wheel so that its free end can move toward and away from the periphery of the escape wheel and with the interposing member extending from the free end of the leaf spring partially into the space between the teeth on said escape wheel, and means for applying a torque to said escape wheel to effect rotation thereof in intermittent steps determined by the leaf spring and the interposing member carried by the same.

2. A mechanical motion regulator as claimed in claim 1 in which the plane of said leaf spring is parallel to the axis of rotation of said escape wheel.

3. A mechanical motion regulator as claimed in claim 1 in which the planes of said leaf spring and of said interposing member are parallel to the axis of rotation of said escape wheel, said interposing member being formed by a plate spring of greater elasticity than said leaf spring.

4. A mechanical motion regulator as claimed in claim 1 in which said interposing member is constituted by a plate spring forming an angle with said leaf spring, the planes of said leaf spring and plate spring being both parallel to the axis of rotation of said escape wheel, and the free end of said plate spring being directed towards said escape wheel.

5. A mechanical motion regulator as claimed in claim 4 in which the relative positions of said escape wheel and said leaf spring are such that for the position of said leaf spring the free end of said plate spring penetrates in the tooth crown of said escape wheel just enough to permit the torque imparted to said escape wheel to overcome the friction resistance and to excite said leaf spring whereby the regulator is set in motion without extraneous assistance.

HERMANN STEIGER.

No references cited.