

Description

ESCAPEMENT MECHANISM FOR A TIMEPIECE MOVEMENT AND ASSOCIATED TIMEPIECE

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Technical field

The present invention relates to the field of watchmaking. More particularly, it relates to an escapement mechanism for a timepiece movement, in particular a Swiss lever escapement mechanism, comprising an escape wheel and an escape anchor including a pivot defining a virtual axis of rotation, of the knife pivot type, and a body extending in a plane perpendicular to said axis of rotation.

The invention also relates to a timepiece including such an escapement mechanism.

Prior art

Lever escapements are most certainly the most common type of escapement in mechanical timepiece mechanisms, at least in the so-called free escapement class. Associated with a regulating organ, typically of the pendulum or sprung balance assembly type, a lever escapement makes it possible to maintain the oscillations of said regulating organ by transmitting to it by regular impulses, at a determined frequency, a fraction of the mechanical energy of the mechanical energy source of a said timepiece mechanism, usually including at least one barrel spring. At the same time, the escapement also makes it possible for the oscillations of the regulating organ to be counted and thus the time to be counted.

Numerous variants of lever escapements have been proposed in the prior art and are well known to the person skilled in the art in the field of watchmaking. Their limitations, which are equally well known, are mainly a propensity to disturb the isochronism of the oscillations of the regulating organ due to the successive shocks and friction between the anchor and the regulating organ on the one hand and the anchor and the escape wheel on the other. These shocks and friction affect the mechanical efficiency of the escapement, especially. It is usually considered that a Swiss lever escapement, for example, only transmits 30-40%, of the driving force it receives from the driving source to the regulating organ.

Various technological solutions have been explored in order to improve the efficiency of the lever escapements, based in particular on the use of new materials such as silicon in particular, in order to reduce the friction of the anchor, both in terms of its pivot and the pallets and the fork.

5 However, these techniques are much more expensive due to the high-tech and specific nature of the production technologies involving deep etching of silicon. In addition, the pieces thus produced are extremely fragile and implementing them requires even greater know-how and precision on the part of the watchmaker, which has limited their use in mass production (several thousands to tens of
10 thousands of pieces per year) on an industrial scale to date.

The object of the present invention is to propose an escapement mechanism of the Swiss lever type, in which the anchor has a new geometry, which can be manufactured according to traditional industrial techniques and using standard materials in the field of watchmaking and which, however, makes it possible to
15 reduce the mechanical disturbances, especially, such as friction, therefore to improve the efficiency of a lever escapement.

Disclosure of the invention

To this end, the invention relates to an escapement mechanism for a timepiece movement comprising an escape wheel and an escape anchor including
20 a pivot defining a virtual axis of rotation and a body extending in a plane perpendicular to said axis of rotation.

According to the invention, the pivot of the escape anchor comprises at least three blades and three corresponding bearing zones on which the blades bear, the points of contact of the blades with the bearing zones being substantially located
25 on the axis of the pivot, the three blades being integral with the body of the escape anchor, and each of the three bearing zones being intended to be integral with a respective frame element of the timepiece movement. Moreover, two of the blades are oriented in the direction of a force that the escape wheel is intended to exert during the operation of the movement, the third blade being oriented in the
30 opposite direction.

The blades oriented in the direction of a force that the escape wheel is intended to exert during the operation of the movement are preferably positioned symmetrically on either side of the extension plane of the body of the escape anchor, extending from said body in a same plane perpendicular to the extension plane of said body.

The bearing zone of each of the blades oriented in the direction of a force that the escape wheel is intended to exert during the operation of the movement is advantageously carried by an arm intended to be integral with a frame element, said arm extending in a plane perpendicular to the axis of the pivot.

The arms carrying the bearing zones of the blades oriented in the direction of a force that the escape wheel is intended to exert during the operation of the movement are advantageously superimposed and connected to a same base intended to be integral with a frame element.

Said base is advantageously mounted so as to be movable on a slide integral with a frame element.

The blade oriented in the opposite direction to that of a force that the escape wheel is intended to exert during the operation of the movement extends, in a preferred manner, from the body of the escape anchor in the same plane as the extension plane of said body.

The bearing zone of the blade oriented in the opposite direction to that of a force that the escape wheel is intended to exert during the operation of the movement is preferably carried by a cylindrical piece having an axis that coincides with the axis of the pivot.

The escapement mechanism advantageously comprises two stones for holding the escape anchor, said stones being disposed on either side of the cylindrical piece carrying the bearing zone of the blade oriented in the opposite direction to that of a force that the escape wheel is intended to exert during the operation of the movement.

Each blade is preferably equipped with a blade wire, and the corresponding bearing zone is a groove extending in a direction parallel to the axis of the pivot and against which the blade wire bears.

The groove preferably has a complementary shape to the blade wire.

5 Said groove advantageously has a dihedral shape in a plane perpendicular to the axis of the pivot.

The escapement mechanism is advantageously arranged to make possible a rotation of the escape anchor about its virtual axis of rotation following an angle of 45° at most, and preferably between 15° and 45°.

10 The invention also relates to a timepiece including an escapement mechanism as defined above.

Brief description of the drawings

Other characteristics and advantages of the present invention will appear on reading the following detailed description of an embodiment of the invention which
15 is provided as a non-limiting example, and with reference to the appended drawings, wherein:

- Fig. 1 is an isometric view of an escapement mechanism according to the invention;
- Figs. 2 and 3 are isometric views showing the escape anchor of Fig. 1
20 and the elements of the frame integral with the bearing zones;
- Fig. 4 is an isometric view of the escape anchor of Fig. 1; and
- Fig. 5 is a top view of the escape anchor of Fig. 1 and the elements of the frame integral with the bearing zones.

Embodiments of the invention

25 With reference to Figs. 1 to 5, a refined timepiece lever escapement mechanism 1 according to a preferred embodiment of the invention is shown. This escapement mechanism 1 is provided with an escape anchor 2, including a pivot 4 defining a virtual axis of rotation Y, and an escape wheel 6.

The anchor 2 includes a body 8 having an overall annular segment shape extending in an extension plane perpendicular to the Y-axis. The body 8 carries at its free ends two arms 10, at the ends of which pallets 12 are arranged in an integral manner, said pallets being intended to cooperate with the teeth of the escape wheel 6 in the manner of a traditional Swiss lever escapement. On the other side of the arms 10, the body 8 extends into a third arm 14 terminated by a fork 16. Said fork 16 has the traditional shape, including two separate horns which are intended to cooperate with an impulse pin 18 driven onto a roller 20 of a balance (not shown). The fork 16 also carries a dart 22.

10 The anchor 2 is mounted so as to be movable in rotation about the virtual axis Y defined by the pivot 4 on a frame element of a timepiece movement such as a plate between the escape wheel 6 and a regulating organ, such as a balance, themselves mounted so as to be movable in rotation on a frame element of the timepiece movement about their own axes of rotation and preferably parallel to
15 that Y defined by the pivot 4.

The escapement mechanism 1 of the invention resembles a traditional Swiss lever escapement, such that the details relating to the escape wheel and the balance are known to the person skilled in the art.

20 However, specifically and advantageously, the pivot 4 of the anchor 2 does not consist of a stem, arbour, or pin driven into a suitable orifice of a plate as in a traditional lever escapement, but consists of a pivot with blades defining a virtual axis of rotation Y. According to the invention, said pivot 4 comprises at least three blades 24, 26, 28 and three respective bearing zones 30, 32, 34 on which the blades 24, 26, 28 bear, the points of contact of the blades 24, 26, 28 with the bearing zones
25 being substantially located on the axis of the pivot 4.

The three blades 24, 26, 28 are integral with the body 8 of the escape anchor 2, positioned inside the space between the arms 10. The three blades 24, 26, 28 can be a single piece on the anchor 2 or can be attached separately.

30 Each of the three bearing zones 30, 32, 34 is intended to be integral with a respective frame element of the timepiece movement, such as a plate or a bridge.

Each blade 24, 26, 28 comprises an edge parallel to the Y-axis, the thinnest and sharpest of the blades 24, 26, 28 of infinitesimal width compared to the other dimensions of the blade 24, 26, 28 defining a blade wire 25, 27, 29 (cf. Fig. 4), and the corresponding bearing zone 30, 32, 34 is a groove extending in a direction
 5 parallel to the axis of the pivot 4 and against which the blade wire 25, 27, 29 bears.

The groove forming the bearing zone 30, 32, 34 advantageously has a complementary shape to the blade wire 25, 27, 29 of the corresponding blade 24, 26, 28, for example in the shape of a V. The groove of the bearing zone 30, 32, 34 preferably has a dihedral shape in a plane perpendicular to the axis of the pivot 4
 10 at the bottom of which the blade wire 25, 27, 29 bears. The bottom of the grooves or bearing zones 30, 32, 34 and the blade wires 25, 27, 29 are advantageously aligned along the axis Y and thus define the virtual axis of the pivot 4 of the escape anchor 2.

The first and second blades 24, 26, and more particularly their ends carrying
 15 the blade wire 25, 27, are oriented in the direction of a force that the escape wheel 6 is intended to exert during the operation of the movement, and the third blade 28, and more particularly its end carrying the blade wire 29, is oriented in the opposite direction in order to stabilise the assembly.

The first and second blades 24, 26 are positioned symmetrically by
 20 protruding on either side of the extension plane of the body 8 of the escape anchor 2, their first arms 24a, 26a extending from said body 8 in a same plane perpendicular to the extension plane of said body 8, and their second arms 24b, 26b carrying at their ends the blade wire 25, 27, 29, extending perpendicularly to the first arms 24a, 26a in the direction of the force exerted by the escape wheel 6
 25 (cf. Fig. 3).

The third blade 28 oriented in the opposite direction to that of a force exerted by the escape wheel 6 extends from the body 8 of the escape anchor 2 in the same plane as the extension plane of said body 8. More particularly, its first arm 28a extends from the body 8 in a same plane as the extension plane of said body 8, and
 30 its second arm 28b carrying at its end the blade wire 29 extends in the same plane as the first arm 28a in the opposite direction to that of the force exerted by the escape wheel 6 (cf. Fig. 4).

The blades 24, 26, 28 are disposed such that the blade wire 29 of the third blade 28 is located along the axis of the pivot 4 between the blade wire 25 of the first blade 24 and the blade wire 27 of the second blade 26.

5 The bearing zone 30, 32 of each of the blades 24, 26 oriented in the direction of a force exerted by the escape wheel 6 is carried by a respective arm 36, 38 intended to be integral with a frame element, said arm 36, 38 extending in a plane perpendicular to the axis of the pivot 4. The bearing zone 30, 32 is preferably provided at the end of the arm 36, 38 respectively, the other end of the arm 36, 38 extending in the form of two brackets 36a, 36b, 38a, 38b integral with a frame
10 element.

Said arms 36, 38 are preferably superimposed and connected to a same base 40 by their brackets 36a, 36b, 38a, 38b, said base 40 being intended to be integral with a frame element such as a plate or a bridge.

15 Said base 40 is advantageously mounted so as to be movable on a slide integral with a frame element. This makes it possible for the base 40 to fit on the first and second blades 24, 26 precisely and thus ensure play-free operation.

20 The bearing zone 34 of the blade 28 oriented in the opposite direction to that of a force exerted by the escape wheel 6 is carried by a cylindrical piece 42 having an axis that coincides with the axis of the pivot 4, said piece 42 being integral with a frame element, such as a bridge or a plate. Said piece 42 can be made of metal such as a copper metal, ceramic or any synthetic material.

25 Furthermore, the escapement mechanism 1 comprises two stones 44 holding the escape anchor 2 which have an axis that coincides with the axis of the pivot 4, said stones 44 being disposed on either side of said cylindrical piece 42. The holding stones 44 make it possible to hold the anchor 2 at a height and to protect it from shocks.

30 Thus, the wire 27 of the second blade 26 and its bearing zone 32, a holding stone 44, the wire 29 of the third blade 28 and its bearing zone 34 carried by the piece 42, the other holding stone 44, and the wire 25 of the first blade 24 are found successively superimposed along the axis of the pivot 4.

Each of the blades 24, 26, 28 pivots through an angle between 15° and 45° in their respective bearing zones 30, 32, 34.

5 Thus, the escapement mechanism 1 according to the invention makes it possible for the escape anchor 2 to rotate about its virtual axis of rotation Y defined by a pivot which is formed on contact of the blade wires 25, 27, 29 with the bottom of the grooves forming the bearing zones 30, 32, 34, following an angle of 45° at most, and preferably between 15° and 45° .

10 The operation of the escapement mechanism 1 of the invention in this embodiment is substantially identical to that of a traditional Swiss lever escapement.

Thanks to its multiple-knife pivoting, the escapement mechanism 1 according to the invention makes it possible to reduce the contact area between the anchor and its pivot by up to 10 times, which provides a significant increase in the efficiency and therefore in the power reserve by reducing the dissipation of driving energy by friction. Wear is also virtually non-existent due to the extremely low contact point. The system can operate without lubrication.

Claims

1. An escapement mechanism (1) for a timepiece movement comprising an escape wheel (6) and an escape anchor (2) including a pivot (4) defining a virtual axis of rotation (Y) and a body (8) extending in a plane perpendicular to said axis of rotation, characterised in that the pivot (4) of the escape anchor (2) comprises at least three blades (24, 26, 28) and three corresponding bearing zones (30, 32, 34) on which the blades (24, 26, 28) bear, the points of contact of the blades (24, 26, 28) with the bearing zones (30, 32, 34) being substantially located on the axis of the pivot (4), the three blades (24, 26, 28) being integral with the body (8) of the escape anchor (2), and each of the three bearing zones (30, 32, 34) being intended to be integral with a respective frame element of the timepiece movement, and in that two of the blades (24, 26) are oriented in the direction of a force that the escape wheel (6) is intended to exert during the operation of the movement, the third blade (28) being oriented in the opposite direction.
2. The escapement mechanism (1) according to Claim 1, characterised in that the blades (24, 26) oriented in the direction of a force that the escape wheel (6) is intended to exert during the operation of the movement are positioned symmetrically on either side of the extension plane of the body (8) of the escape anchor (2), extending from said body (8) in a same plane perpendicular to the extension plane of said body (8).
3. The escapement mechanism (1) according to any one of the preceding claims, characterised in that the bearing zone (30, 32) of each of the blades (24, 26) oriented in the direction of a force that the escape wheel (6) is intended to exert during the operation of the movement is carried by an arm (36, 38) intended to be integral with a frame element, said arm (36, 38) extending in a plane perpendicular to the axis of the pivot (4).
4. The escapement mechanism (1) according to Claim 3, characterised in that the arms (36, 38) carrying the bearing zones (30, 32) of the blades (24, 26) oriented in the direction of a force that the escape wheel (6) is intended to exert during the operation of the movement are superimposed and connected to a same base (40) intended to be integral with a frame element.

5. The escapement mechanism (1) according to Claim 4, characterised in that said base (40) is mounted so as to be movable on a slide integral with a frame element.
- 5 6. The escapement mechanism (1) according to any one of the preceding claims, characterised in that the blade (28) oriented in the opposite direction to that of a force that the escape wheel (6) is intended to exert during the operation of the movement extends from the body (8) of the escape anchor (2) in the same plane as the extension plane of said body (8).
- 10 7. The escapement mechanism (1) according to any one of the preceding claims, characterised in that the bearing zone (34) of the blade (28) oriented in the opposite direction to that of a force that the escape wheel (6) is intended to exert during the operation of the movement is carried by a cylindrical piece (42) having an axis that coincides with the axis of the pivot (4).
- 15 8. The escapement mechanism (1) according to the preceding claim, characterised in that it comprises two stones (44) for holding the escape anchor (2), said stones (44) being disposed on either side of the cylindrical piece (42) carrying the bearing zone (34) of the blade (28) oriented in the opposite direction to that of a force that the escape wheel (6) is intended to exert during the operation of the movement.
- 20 9. The escapement mechanism (1) according to any one of the preceding claims, characterised in that each blade (24, 26, 28) is equipped with a blade wire (25, 27, 29), and in that the corresponding bearing zone (30, 32, 34) is a groove extending in a direction parallel to the axis of the pivot (4) and against which the blade wire (25, 27, 29) bears.
- 25 10. The escapement mechanism (1) according to Claim 9, characterised in that the groove has a complementary shape to the blade wire (25, 27, 29).
11. The escapement mechanism (1) according to any one of Claims 9 and 10, characterised in that the groove has a dihedral shape in a plane perpendicular to the axis of the pivot (4).

12. The escapement mechanism (1) according to any one of the preceding claims, characterised in that it is arranged to make possible a rotation of the escape anchor (2) about its virtual axis of rotation following an angle of at most 45° , and preferably between 15° and 45° .
- 5 13. A timepiece including an escapement mechanism (1) according to any one of Claims 1 to 12.