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(54) OFFSET PALLET LEVER FOR WATCH ESCAPEMENT

(71) We, **TIMEX CORPORATION**, a Corporation organised under the laws of the State of Delaware, United States of America, of Waterbury 20, Connecticut, United States of America, 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:—

This invention relates to an escapement mechanism for a horological device, especially but not necessarily a watch, with an improved pallet lever construction for coupling a toothed escape wheel and an oscillatory balance wheel and to an improved pallet lever construction offering greater flexibility in arranging components making up an escapement.

There are numerous types of escapement which have been highly refined and are well known in the horological art. Most escapements employ an oscillating pallet lever periodically to release a toothed escape wheel by means of a pair of pallet arms on one end, and to provide driving impulses to an oscillating balance wheel through a forked arm co-operating with the balance wheel. Exemplary of such an escapement is United States Patent No. 3,146,581. Pallet levers are usually made of metallic materials with jewels or metal pins serving as the escapement pallets, but pallet levers of plastics material have been suggested, as in United States Patent No. 3,425,212.

In designing the escapement, the designer wishes to be free to arrange the locations of escape wheel and balance wheel and to have the freedom to locate the pivot point of the interconnecting pallet lever wherever he wants in order to reach an optimum ratio of centre distances from escape wheel axis to pallet lever axis versus balance wheel axis to pallet lever axis. Should the pallet lever axis fall within the outer diameter of the balance wheel, the designer has, in the past, had two choices. He must either redesign the escapement so that the pivot points lie outside of the balance wheel axis, or he must locate the pivot points both

on the same side of the balance wheel by utilizing a separate bridge member.

Accordingly, one object of the present invention is to provide an improved pallet lever construction which offers greater flexibility to the designer in locating the pallet lever pivot axis.

Another object of the invention is to provide an improved pallet lever construction which is economical to manufacture as a plastics member.

According to the present invention there is provided a pallet lever for a horological escapement including a toothed escape wheel and an oscillatory balance, said pallet lever comprising a first portion, a second offset portion depending from the first portion and a third portion extending from the second portion, the first and third portions being arranged for pivotal mounting from respectively opposite sides about an axis spaced from the second portion whereby part of the balance may oscillate along a path intersecting the said axis.

Also according to the present invention there is provided an escapement for a horological device, said escapement comprising a toothed escape wheel, an oscillatory balance wheel with portions oscillating through an arc with an outer diameter, and a pivotable pallet lever to controllably release the escape wheel by means of a pair of pallet arms and provide driving impulses to the balance wheel by means of an impulse arm, said pallet lever comprising a first portion pivotably mounted on one side of the balance wheel within said outer diameter thereof, a second offset portion extending axially from the first portion and outside the outer diameter of the balance wheel, and a third portion extending from the second portion and pivotably mounted on the opposite side of the balance wheel from said first portion, said first, second, and third portions being arranged to provide said pallet lever with pivot points inside the outer diameter of the balance wheel and on opposite sides thereof.

The improved pallet lever of the present

invention allows the designer to place the pivot point of the pallet lever inside the outer diameter of the oscillating balance wheel and offers other improved features, as well, when it is manufactured in the preferred embodiment from a single plastics piece.

Briefly stated, an embodiment of the invention comprises an improved pallet lever having a pair of pallet arms and a forked impulse arm and having a first portion pivotably mounted on one side of the balance wheel, an offset axial portion passing outside of the balance wheel diameter, and a third portion connected to the offset portion and providing the second pivotable mounting on the opposite side of the balance wheel. Preferably the aforesaid three portions are part of a single moulding of wear-resistant plastics.

The invention will be more clearly understood by reference to the following description taken in connection with the accompanying drawings, in which:—

Figure 1 is a plan view of an escapement mechanism with a pallet lever according to the invention, and

Figure 2 is a sectional elevation of the mechanism and with pertinent portions rotated into the plane of the drawing.

Referring to Figure 1 of the drawings, portions of a conventional toothed escape wheel are shown at 1 with teeth 2 formed to provide the usual functions, as set forth in the aforementioned United States Patent No. 3,146,581. Briefly, however, the teeth 2 are provided with special banking surfaces 3 and inclined impulse faces 4. The escape wheel is urged in the direction indicated by the arrow by a gear train and spring mechanism (not shown).

A conventional oscillating balance wheel is shown at 5 with an inner hub 6 and an outer rim 7 connected by spokes 8. Hub 6 is mounted on a balance staff 9 having an integral safety roller 10 with indented portion 10a. Also projecting axially from hub 6 is a roller pin 11 (see Fig. 2).

All of the aforementioned portions of the escapement mechanism are largely conventional and may be substantially modified without departing from the present invention. The improved pallet lever, which embodies the present invention, is seen to comprise a first portion 12 pivotably mounted on the top side of the balance wheel at an axis 13 lying inside the outer diameter of rim 7 of the balance wheel. This first portion includes a pair of pallet arms 14 and 15 with pallets 16 and 17 formed integrally therewith. Pallets 16 and 17 have inclined impulse faces 16a, 17a which alternately co-operate with impulse faces 4 of the escape wheel teeth. The first pallet lever portion 12 also has an impulse arm 18 with

a flat section 18a terminating in a conventional forked end 19 arranged to co-operate with the roller pin 11. Impulse arm 18 has also an integral rib 18b terminating in a projection 20 which co-operates with the indentation 10a in the safety roller in conventional manner.

The pallet lever has a second offset axially extending portion 21 which is preferably moulded as an integral hollow column depending from one of the pallet arms 15. This is better seen by reference to Figure 2 which is a developed or rotated projection giving some distortion of the shape of the parts, but illustrating the method of operation. The escape wheel 1, balance wheel 5, and pallet lever 12 are all pivotably mounted between opposed plate members, here frame plate 22 and bridge member 23. Escape wheel 1 is carried on shaft 24 having journal bearings 25. The balance wheel staff 9 oscillates in V-shaped jewel bearings 26, oscillatory counter-force being provided by a conventional hairspring 27.

The pallet lever also includes a third portion 28 which extends from the offset portion 21 under rim 7 on the opposite side of the balance wheel. A steel pin 29 provides a first pivotal mounting by extending from frame 22 into an aperture 30 in the portion 28 of the pallet lever. Similarly, a co-axial pin 31, extending from the bridge 23 into a recess 32 in the upper portion 12 of the pallet lever, provides a second pivotal mounting.

In operation, the balance wheel 5 oscillates through the combined action of the hairspring 27 and periodic impulses imparted to the roller pin 11 by impulse arm 18 of the pallet lever. The escape wheel 1 is periodically released by, and provides driving impulses to, the pallet arms. The pallet lever oscillates in the normal manner about axis 13. However, because of the novel construction, the two co-axial pins 29, 31 about which it pivots can be located within the effective outer diameter of balance wheel 5, i.e. within the outer diameter of rim 7 or any projections therefrom. Of course, if the balance wheel is constructed such that it has only a partial outer rim, it is understood that the term "outer diameter" as used herein means the diameter of the outer reach of any oscillating portions of the balance wheel.

While it is preferred that the first, second and third portions of the pallet lever be all moulded as a single plastics member, it is within the purview of the present invention to form the pallet lever of separate pieces, for example, by using metal plate members for portions 12 and 28 connected by a separate offset portion 21. Also it is possible to put the pallet arms on the bottom or third portion 28, leaving the impulse arm

19 on the top or first portion 12. This is especially feasible if the pallet lever is made up of separate pieces. However, an integral plastics lever with hollow column is the preferred embodiment of the invention, is very rigid and provides an outstanding construction when moulded from a single piece of wear-resistant plastics such as acetal glass-filled plastics. Also the use of integral pallets on the pallet arms using the aforesaid plastics material, provides a very economical pallet lever construction, by eliminating the usual jewels or pins.

WHAT WE CLAIM IS:—

1. A pallet lever for a horological escapement including a toothed escape wheel and an oscillatory balance, said pallet lever comprising a first portion, a second offset portion depending from the first portion and a third portion extending from the second portion, the first and third portions being arranged for pivotal mounting from respectively opposite sides about an axis spaced from the second portion whereby part of the balance may oscillate along a path intersecting the said axis.

2. An escapement for a horological device, said escapement comprising a toothed escape wheel, an oscillatory balance wheel with portions oscillating through an arc with an outer diameter, and a pivotable pallet lever to controllably release the escape wheel by means of a pair of pallet arms and provide driving impulses to the balance wheel by means of an impulse arm, said pallet lever comprising a first portion pivotably mounted on one side of the balance wheel within said outer diameter thereof, a second offset portion extending axially from the first portion and outside the outer diameter of the balance wheel, and a third portion extending from the second portion and pivotably mounted on the opposite side

of the balance wheel from said first portion, said first, second, and third portions being arranged to provide said pallet lever with pivot points inside the outer diameter of the balance wheel and on opposite sides thereof.

8. A pallet lever substantially as herein-Claim 2, wherein said first, second and third portions are made as an integral member of wear-resistant plastics.

4. The structure according to any one of Claims 1 to 3, wherein said first portion includes said pair of pallet arms and wherein said offset portion depends from one of said pallet arms.

5. The structure according to any one of Claims 1 to 4, wherein said first portion includes an impulse arm comprising a plastics member with a flat section terminating in a fork and an integral rib terminating in a projection, said fork and projection being adapted for co-operative association with portions of the balance wheel.

6. The structure according to any one of Claims 1 to 5, wherein said second portion is a hollow column of plastics material integrally formed with said first and third portions of the lever.

7. The structure according to Claim 6, wherein said first portion further includes pallet arms having projecting integral pallets adapted to co-operate with the teeth of said escape wheel.

8. A pallet lever substantially as hereinbefore described with reference to the accompanying drawings.

9. A horological escapement substantially as hereinbefore described with reference to the accompanying drawings.

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2. An escapement for a horological device, said escapement comprising a toothed escape wheel, an oscillatory balance wheel with portions oscillating through an arc with an outer diameter, and a pivotable pallet lever to controllably release the escape wheel by means of a pair of pallet arms and provide driving impulses to the balance wheel by means of an impulse arm, said pallet lever comprising a first portion pivotably mounted on one side of the balance wheel within said outer diameter thereof, a second offset portion extending axially from the first portion and outside the outer diameter of the balance wheel, and a third portion extending from the second portion and pivotably mounted on the opposite side

of the balance wheel from said first portion, said first, second, and third portions being arranged to provide said pallet lever with pivot points inside the outer diameter of the balance wheel and on opposite sides thereof.

8. A pallet lever substantially as herein-Claim 2, wherein said first, second and third portions are made as an integral member of wear-resistant plastics.

4. The structure according to any one of Claims 1 to 3, wherein said first portion includes said pair of pallet arms and wherein said offset portion depends from one of said pallet arms.

5. The structure according to any one of Claims 1 to 4, wherein said first portion includes an impulse arm comprising a plastics member with a flat section terminating in a fork and an integral rib terminating in a projection, said fork and projection being adapted for co-operative association with portions of the balance wheel.

6. The structure according to any one of Claims 1 to 5, wherein said second portion is a hollow column of plastics material integrally formed with said first and third portions of the lever.

7. The structure according to Claim 6, wherein said first portion further includes pallet arms having projecting integral pallets adapted to co-operate with the teeth of said escape wheel.

8. A pallet lever substantially as hereinbefore described with reference to the accompanying drawings.

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