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DRAWINGS ATTACHED

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(54) INDEXING MECHANISM FOR HOROLOGICAL INSTRUMENTS

(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:—

The present invention relates to horology and more particularly to an indexing arrangement for timepieces e.g. watches.

The United States Patent No. 3,462,942 discloses a now common dial train drive. An oscillating balance wheel drives a lever to and fro in order to step an index wheel. A magnet is provided for each step of circular pitch of the index wheel so that a direct or indirect magnetic influence holds the lever as well as the index wheel. United States Patents Nos. 3,298,170 and 3,396,531 are also of interest in this area.

Another United States Patent representative of the prior art is Patent No. 3,122,879 which discloses a driving mechanism for electrically driven rotary oscillators in which the lever or fork is held in its extreme positions and in which the jumping or slipping of the stepping wheel is reliably prevented by means of a safety cam.

It is an object of this invention to provide a new and improved indexing mechanism for timepieces.

It is another object of this invention to provide an indexing mechanism for timepieces wherein detenting of the index wheel is accomplished by a drag spring arrangement.

According to this invention there is provided an indexing mechanism for timepieces comprising a frame,

an oscillatory balance means, means to impulse the balance means to provide oscillatory movement thereof,

an index lever rotatably mounted to the frame and oscillated by the balance means, an index wheel having a plurality of teeth positioned about the periphery to be engaged by the index lever and a drag disc mounted thereto, said drag disc having a

plurality of teeth positioned about the periphery thereof, and

a drag spring having one end mounted to the frame and the other end free to engage the teeth of the drag disc, said spring engaging the teeth upon completion of each movement of the index wheel to prevent any reverse movement thereof.

An embodiment of the invention is an indexing mechanism for electric or electronic timepieces wherein a balance wheel assembly drives an index lever causing oscillation thereof. A pair of spaced apart index pins are mounted on the index lever to alternately engage the teeth of an index wheel advancing each tooth by $\frac{1}{2}$ pitch.

A ferro-magnetic draw lever attached to the index lever interacts with an indexing magnet mounted on the plate to hold the draw lever in extreme positions against the banking pins. In contrast to the conventional arrangements of prior art, the indexing magnet does not act on the index wheel. Detenting of the index wheel is accomplished by a one-direction drag spring which is fastened to the frame and which has its free end in contact with the teeth of a drag disc. The drag disc has a large plurality of teeth positioned about its periphery to permit proper detenting of the index wheel regardless of drag spring length or tolerances due to pitch errors.

An embodiment of the invention will now be described with reference to the accompanying generally schematic drawings wherein:—

Fig. 1 is a plan view of an indexing mechanism according to the invention for an electric or electronic watch, and

Fig. 2 is a partially cross-sectioned side view taken along the line 2—2 of Fig. 1.

The driving of an indexing mechanism or dial train by a balance wheel and the transmission of the balance wheel's motion by a lever to an index wheel are known in watches. The representation of these parts is therefore only shown schematically in the drawings. Furthermore, the impulsing of the balance wheel either electrically or electronically, and the transmission of the motion of

the index wheel to the dial train is also known and is therefore omitted from the drawings.

The indexing mechanism shown in Figs. 1 and 2 comprises a balance wheel assembly 10 mounted about a balance staff 11. The balance staff 11 includes a safety roller 14 and is journaled for rotation in bearing means 16 in a front frame 17. The balance wheel assembly 10 includes also an impulse disc 12 having an impulse pin 13 extending downwardly therefrom.

The impulse pin 13 engages the bifurcated end portion 22 of an index lever 18 as the impulse disc 12 oscillates back and forth under the urging of the balance wheel drive (not shown). The index lever 18 is mounted to an arbor 38 which is journaled at its end portions in the front frame 17 and a train bridge 39. The lever 18 oscillates between banking pins 19 and 21 as index pins 23 and 24 carried thereby alternately engage the teeth 26 of an index wheel 27. The pins 23 and 24 are mounted respectively on arms 28 and 29 of the lever 18 to effect the movement of the index wheel 27 as shown in phantom in Fig. 1. Each index pin advances the index wheel 27 by one-half pitch during each half oscillation of the lever 18.

A ferro-magnetic draw lever 31 is mounted to the index lever 18. The draw lever 31 is substantially U-shaped and its outwardly extending arms interact with an indexing magnet 32. Indexing magnets are generally used not only to hold the draw lever 18 in its extreme position against banking pins 19 and 21 but also to interact with the index wheel teeth 26 to hold the index wheel 27 in position when the index pins 23 and 24 disengage from the teeth 26. In the present invention, however, the indexing magnet 32 does not act on the index wheel 27. Detenting of the index wheel 27 is accomplished by the action of a one direction drag spring 33 which is fastened at one end to a frame post 34 and engages the teeth 36 of a drag disc 37 with its free end. The drag disc 37 is mounted concentrically to the index wheel 27.

The drag disc 37 is preferably of plastic material and includes on its periphery a very substantial number of teeth 36, the number of teeth 36 being a substantial number of times the number of teeth of the index wheel 27 for example 2N times the number of teeth of the index wheel 27 (2N being a number which gives the highest number of teeth practicable on the disc 37). This permits proper detenting of the index wheel 27 regardless of drag spring length and of tolerances due to pitch errors. The need for accurate alignment between the index wheel teeth 26 and drag disc teeth 36 is thereby eliminated. Due to the fine pitch of the drag disc teeth 36, the free end of the drag spring

33 need be positioned only slightly past a plane extending through the centre-line of the index wheel 27 and the end of the spring 33 fixed to frame post 34 and will still lock into the drag disc teeth 36 when reverse torque is applied to the index wheel 27.

In operation, the impulse pin 13 intermittently engages the forked end portion 22 of the index lever 18 during oscillation of the balance wheel assembly 10. The lever 18 is oscillated back and forth between banking pins 19 and 21 while the indexing magnet 32 acts on the bifurcated draw lever 31 to hold the lever 18 in its extreme positions against the banking pins 19 and 21.

The index pins 23 and 24 alternately engage the teeth 26 of index wheel 27 driving the wheel 27 in the indicated direction (Fig. 1). Each half oscillation of the lever 18 moves the wheel 27 an amount equal to $\frac{1}{2}$ the tooth pitch. Any reverse movement of the wheel is prevented by the drag disc 37 which is engaged by the free end of drag spring 33. A precise engagement is possible since the drag disc 37 includes a plurality of teeth 36 to be contacted by the spring 13.

WHAT WE CLAIM IS:—

1. An indexing mechanism for timepieces comprising a frame,

an oscillatory balance means,

means to impulse the balance means to provide oscillatory movement thereof,

an index lever rotatably mounted to the frame and oscillated by the balance means,

an index wheel having a plurality of teeth positioned about the periphery to be engaged by the index lever and a drag disc mounted thereto, said drag disc having a plurality of teeth positioned about the periphery thereof, and

a drag spring having one end mounted to the frame and the other end free to engage the teeth of the drag disc, said spring engaging the teeth upon completion of each movement of the index wheel to prevent any reverse movement thereof.

2. An indexing mechanism in accordance with claim 1 further including:

at least two banking pins mounted to the frame at spaced intervals on opposite sides of the index lever to limit the movement thereof,

a draw lever connected to the index lever for movement therewith, and,

a magnet mounted to the frame to cooperate with the draw lever to hold the index lever in its extreme positions against the banking pins.

3. An indexing mechanism in accordance with claim 2 wherein:

the draw lever comprises a substantially U-shaped member having outwardly extending arms wherein the extending arms interact with the indexing magnet.



the index wheel to the dial train is also known and is therefore omitted from the drawings.

5 The indexing mechanism shown in Figs. 1 and 2 comprises a balance wheel assembly 10 mounted about a balance staff 11. The balance staff 11 includes a safety roller 14 and is journaled for rotation in bearing means 16 in a front frame 17. The balance wheel assembly 10 includes also an impulse disc 12 having an impulse pin 13 extending downwardly therefrom.

10 The impulse pin 13 engages the bifurcated end portion 22 of an index lever 18 as the impulse disc 12 oscillates back and forth under the urging of the balance wheel drive (not shown). The index lever 18 is mounted to an arbor 38 which is journaled at its end portions in the front frame 17 and a train bridge 39. The lever 18 oscillates between banking pins 19 and 21 as index pins 23 and 24 carried thereby alternately engage the teeth 26 of an index wheel 27. The pins 23 and 24 are mounted respectively on arms 28 and 29 of the lever 18 to effect the movement of the index wheel 27 as shown in phantom in Fig. 1. Each index pin advances the index wheel 27 by one-half pitch during each half oscillation of the lever 18.

15 A ferro-magnetic draw lever 31 is mounted to the index lever 18. The draw lever 31 is substantially U-shaped and its outwardly extending arms interact with an indexing magnet 32. Indexing magnets are generally used not only to hold the draw lever 18 in its extreme position against banking pins 19 and 21 but also to interact with the index wheel teeth 26 to hold the index wheel 27 in position when the index pins 23 and 24 disengage from the teeth 26. In the present invention, however, the indexing magnet 32 does not act on the index wheel 27. Detenting of the index wheel 27 is accomplished by the action of a one direction drag spring 33 which is fastened at one end to a frame post 34 and engages the teeth 36 of a drag disc 37 with its free end. The drag disc 37 is mounted concentrically to the index wheel 27.

20 The drag disc 37 is preferably of plastic material and includes on its periphery a very substantial number of teeth 36, the number of teeth 36 being a substantial number of times the number of teeth of the index wheel 27 for example 2N times the number of teeth of the index wheel 27 (2N being a number which gives the highest number of teeth practicable on the disc 37). This permits proper detenting of the index wheel 27 regardless of drag spring length and of tolerances due to pitch errors. The need for accurate alignment between the index wheel teeth 26 and drag disc teeth 36 is thereby eliminated. Due to the fine pitch of the drag disc teeth 36, the free end of the drag spring

33 need be positioned only slightly past a plane extending through the centre-line of the index wheel 27 and the end of the spring 33 fixed to frame post 34 and will still lock into the drag disc teeth 36 when reverse torque is applied to the index wheel 27.

25 In operation, the impulse pin 13 intermittently engages the forked end portion 22 of the index lever 18 during oscillation of the balance wheel assembly 10. The lever 18 is oscillated back and forth between banking pins 19 and 21 while the indexing magnet 32 acts on the bifurcated draw lever 31 to hold the lever 18 in its extreme positions against the banking pins 19 and 21.

30 The index pins 23 and 24 alternately engage the teeth 26 of index wheel 27 driving the wheel 27 in the indicated direction (Fig. 1). Each half oscillation of the lever 18 moves the wheel 27 an amount equal to $\frac{1}{2}$ the tooth pitch. Any reverse movement of the wheel is prevented by the drag disc 37 which is engaged by the free end of drag spring 33. A precise engagement is possible since the drag disc 37 includes a plurality of teeth 36 to be contacted by the spring 13.

WHAT WE CLAIM IS:—

1. An indexing mechanism for timepieces comprising a frame,

an oscillatory balance means, means to impulse the balance means to provide oscillatory movement thereof,

an index lever rotatably mounted to the frame and oscillated by the balance means,

an index wheel having a plurality of teeth positioned about the periphery to be engaged by the index lever and a drag disc mounted thereto, said drag disc having a plurality of teeth positioned about the periphery thereof, and

a drag spring having one end mounted to the frame and the other end free to engage the teeth of the drag disc, said spring engaging the teeth upon completion of each movement of the index wheel to prevent any reverse movement thereof.

2. An indexing mechanism in accordance with claim 1 further including:

at least two banking pins mounted to the frame at spaced intervals on opposite sides of the index lever to limit the movement thereof,

a draw lever connected to the index lever for movement therewith, and,

a magnet mounted to the frame to cooperate with the draw lever to hold the index lever in its extreme positions against the banking pins.

3. An indexing mechanism in accordance with claim 2 wherein:

the draw lever comprises a substantially U-shaped member having outwardly extending arms wherein the extending arms interact with the indexing magnet.

4. An indexing mechanism in accordance with any one of claims 1 to 3 wherein:
the drag disc comprises a plastic member
- having a very substantial number of teeth
5 moulded therein, said disc being mounted concentrically with the index wheel, and,
the free end of the drag spring is positioned slightly to one side of a plane extending through the centreline of the index wheel
10 and the other end of the drag spring to engage the teeth of the drag disc to prevent reverse movement thereof.
5. An indexing mechanism in accordance with any one of claims 1 to 4 wherein:
15 the index lever has bifurcated end portions, one of said end portions having a pair of arms and an index pin mounted to each arm to alternately engage the index wheel teeth to advance the index wheel an amount equal to one-half the tooth pitch 20 during each engagement.
6. An indexing mechanism substantially as hereinbefore described with reference to the accompanying drawings.
7. A watch including the indexing mechanism as claimed in any one of the preceding claims. 25

STEVENS, HEWLETT & PERKINS,
Chartered Patent Agents,
5, Quality Court,
Chancery Lane,
London, W.C.2.

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