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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 mechanism for a timepiece, especially a watch.

In conventional indexing systems, magnets are often provided to step or hold the index wheel. For example, United States Patent No. 2,462,942 discloses a now common dial train drive in which 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.

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

It is another object of this invention to provide an indexing mechanism for timepieces including magnet means for holding the index lever in its banking positions.

According to the invention there is provided an indexing mechanism for a timepiece comprising:

- a frame;
- an oscillatory balance means;
- means to impulse the balance means to provide oscillatory movement thereof;
- an index lever rotatably mounted on the frame to be oscillated by the balance means;
- at least two banking pins mounted on the frame at spaced intervals on opposite sides of the index lever to limit the movement thereof;
- an index wheel having a plurality of teeth positioned about its periphery;
- the index lever including bifurcated end portions, one of said end portions having a pair of arms and an index pin mounted on each arm to alternately engage the index wheel teeth for advancing the index wheel a

predetermined step during each engagement; and,

at least one magnet positioned adjacent the index wheel teeth to hold the index wheel at the end of each step by exerting a torque on successive index wheel teeth and hence on the index wheel and the lever, and momentarily holding the lever against alternate ones of the banking pins.

An embodiment of the invention is an indexing mechanism for electric or electronic timepieces wherein the balance wheel assembly drives an index lever causing oscillation thereof. A pair of spaced apart index pins are mounted on the arms of the index lever to alternately engage the teeth of an index wheel advancing each tooth by one-half pitch. A banking pin at each side of the index lever limits the oscillatory movement of the lever.

The index wheel is held in its rest position at each of its one-half pitch steps by one or more indexing magnets. The indexing magnets are positioned to interact magnetically with successive teeth of the index wheel and exert a torque on the teeth so that the index pins are locked successively against draw faces of the index wheel teeth, whereby the lever is thus held in its banking or end position at the end of each step.

Preferred embodiments of the present invention will now be described with reference to the accompanying generally schematic drawings in which:—

Figure 1 is a plan view of an indexing mechanism according to the invention for an electric or electronic watch;

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

Figure 3 is a plan view of a second embodiment of an indexing mechanism according to the invention; and

Figure 4 is a partial cross-sectional view taken along the line 4—4 of Figure 3.

The driving of an indexing mechanism and 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 also omitted

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

15 The impulse pin 13 engages the forked end portion 22 of an index lever 18 as the impulse disc 12 oscillates back and forth with the balance wheel (not shown). The index lever 18 is mounted on an arbor 38 which is journaled at its end portions in the front
20 frame 17 and a train bridge 39 respectively. The lever 18 oscillates between banking pins 19 and 21 as index pins 23 and 24 mounted respectively on arms 28 and 29 of the lever 18 alternately engage the teeth 26 of an index
25 wheel 27 to effect the movement of the index wheel 27 as shown in phantom in Figs. 1 and 3. Each index pin advances the index wheel 27 by one-half pitch during each corresponding half oscillation of the lever 18.

30 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 thus oscillated back and forth between banking pins 19 and 21 while the index pins 23
35 and 24 engage the teeth 26 of the index wheels 27. The pins 23 and 24 advance the index wheel 27 in one-half pitch steps in the indicated direction.

40 The index wheel 27 which is of ferromagnetic material is held in its rest position at the end of each one-half pitch step by two indexing magnets, 40 and 41 in Figs. 1 and 2 and 44 and 45 in Figs. 3 and 4, positioned adjacent the teeth of the index wheel
45 27. While only two magnets are shown in either embodiment, it is to be understood that more than two magnets could be used.

50 In the embodiment of Figures 1 and 2, indexing magnets 40 and 41 are positioned to interact with successive index wheel teeth on the completion of each advancing step of the index wheel to exert a forward torque in the direction of index wheel movement
55 on the index wheel. Such forward torque locks the index pin 24 against the forward draw face of tooth 42 thereby holding the lever 18 in an end position against banking pin 21. On the completion of the next one-half pitch step of the index wheel, the index
60 pin 23 is similarly held against the forward draw face of index wheel tooth 42 and the lever 18 against banking pin 19 as shown in phantom. The lever 18 must be held momentarily in its banked position to permit
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functioning of the indexing mechanism and to prevent any reverse movement thereof.

The embodiment of Figures 3 and 4 is similar to that of Figures 1 and 2, the distinction residing in that the magnets 44 and 45
70 are positioned to provide a reverse torque on the index wheel. The reverse torque provided by such positioning of the magnets 44 and 45 acts to lock the index pins successively against the reverse draw faces 46 of the index wheel teeth 26 to hold the lever
75 18 in a banked position against pin 21 or, as shown in phantom, pin 19. The magnetic torque is applied in a direction opposite to the normal movement of the index wheel 27.

The improved indexing mechanism as described above permits the precise indexing required in a watch and provides a highly efficient system for stepping and holding the
85 index wheel, and one which furthermore functions with a minimum of parts to provide the desired indexing.

Having regard to the provisions of Section 9 of the Patent Act, attention is directed
90 to the claims of Patent No. 1,003,814.

WHAT WE CLAIM IS:—

1. An indexing mechanism for a time-piece comprising:

95 a frame;
an oscillatory balance means;
means to impulse the balance means to provide oscillatory movement thereof;
an index lever rotatably mounted on the
100 frame to be oscillated by the balance means;
at least two banking pins mounted on the frame at spaced intervals on opposite sides of the index lever to limit the movement thereof;

105 an index wheel having a plurality of teeth positioned about its periphery; the index lever including bifurcated end portions, one of said end portions having a pair of arms and an index pin mounted on each arm to alternately engage the index wheel teeth for advancing the index wheel a predetermined step during each engagement; and,

115 at least one magnet positioned adjacent the index wheel teeth to hold the index wheel at the end of each step by exerting a torque on successive index wheel teeth and hence on the index wheel and the lever, and momentarily holding the lever against alternate ones of the banking pins.

120 2. An indexing mechanism in accordance with Claim 1 wherein:

the index pins advance the index wheel by an amount equal to one-half the tooth pitch during each engagement; and

125 the index wheel teeth include shaped draw faces to be engaged by the index pins.

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

the at least one magnet comprises a pair 130

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 also omitted

5 The indexing mechanism shown in the drawings comprises a balance wheel assembly 10 mounted on a balance staff 11. The balance 11 includes a safety roller 14 and is journalled for rotation in bearing means 16 in a front frame 17. The balance wheel assembly 10 also includes an impulse disc 12 having an impulse pin 13 extending downward therefrom.

15 The impulse pin 13 engages the forked end portion 22 of an index lever 18 as the impulse disc 12 oscillates back and forth with the balance wheel (not shown). The index lever 18 is mounted on an arbor 38 which is journalled at its end portions in the front frame 17 and a train bridge 39 respectively. 20 The lever 18 oscillates between banking pins 19 and 21 as index pins 23 and 24 mounted respectively on arms 28 and 29 of the lever 18 alternately engage the teeth 26 of an index wheel 27 to effect the movement of the index wheel 27 as shown in phantom in Figs. 1 and 3. Each index pin advances the index wheel 27 by one-half pitch during each corresponding half oscillation of the lever 18.

30 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 thus oscillated back and forth between banking pins 19 and 21 while the index pins 23 and 24 engage the teeth 26 of the index wheels 27. The pins 23 and 24 advance the index wheel 27 in one-half pitch steps in the indicated direction.

40 The index wheel 27 which is of ferromagnetic material is held in its rest position at the end of each one-half pitch step by two indexing magnets, 40 and 41 in Figs. 1 and 2 and 44 and 45 in Figs. 3 and 4, positioned adjacent the teeth of the index wheel 27. While only two magnets are shown in either embodiment, it is to be understood that more than two magnets could be used.

50 In the embodiment of Figures 1 and 2, indexing magnets 40 and 41 are positioned to interact with successive index wheel teeth on the completion of each advancing step of the index wheel to exert a forward torque in the direction of index wheel movement on the index wheel. Such forward torque locks the index pin 24 against the forward draw face of tooth 42 thereby holding the lever 18 in an end position against banking pin 21. On the completion of the next one-half pitch step of the index wheel, the index pin 23 is similarly held against the forward draw face of index wheel tooth 42 and the lever 18 against banking pin 19 as shown in phantom. The lever 18 must be held momentarily in its banked position to permit

functioning of the indexing mechanism and to prevent any reverse movement thereof.

The embodiment of Figures 3 and 4 is similar to that of Figures 1 and 2, the distinction residing in that the magnets 44 and 45 are positioned to provide a reverse torque on the index wheel. The reverse torque provided by such positioning of the magnets 44 and 45 acts to lock the index pins successively against the reverse draw faces 46 of the index wheel teeth 26 to hold the lever 18 in a banked position against pin 21 or, as shown in phantom, pin 19. The magnetic torque is applied in a direction opposite to the normal movement of the index wheel 27.

The improved indexing mechanism as described above permits the precise indexing required in a watch and provides a highly efficient system for stepping and holding the index wheel, and one which furthermore functions with a minimum of parts to provide the desired indexing.

Having regard to the provisions of Section 9 of the Patent Act, attention is directed to the claims of Patent No. 1,003,814.

WHAT WE CLAIM IS:—

1. An indexing mechanism for a time-piece comprising:

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an oscillatory balance means;
means to impulse the balance means to provide oscillatory movement thereof;
an index lever rotatably mounted on the frame to be oscillated by the balance means;
at least two banking pins mounted on the frame at spaced intervals on opposite sides of the index lever to limit the movement thereof;

an index wheel having a plurality of teeth positioned about its periphery; the index lever including bifurcated end portions, one of said end portions having a pair of arms and an index pin mounted on each arm to alternately engage the index wheel teeth for advancing the index wheel a predetermined step during each engagement; and,
at least one magnet positioned adjacent the index wheel teeth to hold the index wheel at the end of each step by exerting a torque on successive index wheel teeth and hence on the index wheel and the lever, and momentarily holding the lever against alternate ones of the banking pins.

2. An indexing mechanism in accordance with Claim 1 wherein:

the index pins advance the index wheel by an amount equal to one-half the tooth pitch during each engagement; and
the index wheel teeth include shaped draw faces to be engaged by the index pins.

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

the at least one magnet comprises a pair



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of spaced-apart magnets which are positioned to interact each with successive teeth of the index wheel and exert a forward torque on the teeth thus locking the pins of the index lever against the forward draw faces.

5 4. An indexing mechanism in accordance with Claim 2 wherein:

the at least one magnet comprises a pair of spaced-apart magnets which are positioned to interact each with successive teeth of the index wheel and exert a reverse torque on the teeth thus locking the pins of the index lever against the reverse draw faces.

5. An indexing mechanism substantially as hereinbefore described with reference to Figures 1 and 2 or Figures 3 and 4 of the accompanying drawings. 15

6. A watch including an indexing mechanism as claimed in any one of the preceding claims. 20

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