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PATENT SPECIFICATION

(11) 1391233

1391233

- (21) Application No. 1012/73 (22) Filed 8 Jan. 1973
(31) Convention Application No. 2202846 (32) Filed 21 Jan. 1972 in
(33) Germany (DT)
(44) Complete Specification published 16 April 1975
(51) INT CL² G04B 27/06 F16F 1/22 G04C 3/04
(52) Index at acceptance
G3T A10C1 A10C2 A5B1 A8
F2S 5H1B 5H5C



(54) HAND-SETTING MECHANISM

(71) We, TIMEX CORPORATION, a Corporation organized 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 horological movements and more particularly to a hand-setting and stopping device for a horological movement, for example a mechanical or an electric watch or clock.

On the presently available mechanical watches, a stem is customarily provided that can be drawn out of a normal inner position into an outer position. In the inner position the stem can be rotated by means of a crown mounted thereon, whereby meshing gear wheels wind up a mechanical mainspring to power the entire movement by rotation of its barrel cover. When drawing out the stem a pivotal cock is shifted so that the operating connection between the going barrel and a gear on the cock is interrupted. Simultaneously, by shifting the cock, a small cock wheel is brought into mesh with a minute wheel which, in turn, is operatively connected with a gear of the dial train drive so that, upon turning the stem, the hands can be set. On the known mechanism a spring is provided which normally urges the cock towards its connection with the going barrel. In one type of known movement, in order to bring the minute hand into exact coincidence with the seconds hand, a separate arresting member is provided that acts at the same time that the cock is shifted to stop the balance wheel. This is sometimes called a "hack" feature.

On electrically driven watches using an oscillating balance wheel assembly, it is customary to effect the stopping of the balance in such a manner that the connection between the coil, generally carried on the balance wheel, and the battery installed in the case, is broken. Consequently, no current is drawn

from the battery when the movement stands still. In addition, on these movements the shiftable cock has no cock wheel that acts on the mainspring, because no such mainspring is provided in this case.

An object of the present invention is to substantially simplify the construction and lessen the costs of these known movements so that the connection between the spring member, acting upon the cock, and the arresting member that stops the balance, is effected in the shortest way.

According to one aspect of the present invention there is provided a horological movement including an oscillator, a hand-setting stem which is axially shiftable between a first inner position relative to said movement and a second outer position, a cock pivotally mounted for movement from a first position into a second hand-setting position in response to axial shifting of the stem into its outer position, and a resilient member, said resilient member having a coupling section which biases said cock towards its first position and a spring lever arcuate section which in the outer position of the stem acts against the oscillator to stop the oscillator, wherein said resilient member has one portion fixed to said movement and is in contact with and movable by said cock.

A particularly favourable configuration results when the entire resilient member is an integral multipurpose spring. A suitable spring can, for example, be formed from a bent wire spring or a correspondingly curved flat spring.

In certain movements, the coupling section which biases the cock ought to have a comparatively strong spring force, but such a strong spring force is not necessary for the arcuate section. On the contrary, it is advantageous if the influence upon the balance is effected by a relatively weak spring force. This results in one preferred construction where the coupling section which spring biases the cock member has a relatively strong spring force, and the spring lever arcuate section that holds the balance wheel, has a relatively weak spring force.

On mechanical and electrical timepieces the effect on the balance wheel, or vibrator, is favourable if the spring lever arcuate section has a stop portion which contacts the balance wheel or vibrator. It is of advantage in this case if the stop portion is the free end of the spring. Such stop portion can be bent so that it is aligned in a direction parallel to said balance staff.

After setting the hands, in order to automatically re-start the movement, preferably the stop portion of the spring lever, in its movement into its starting position, moves along the periphery of the balance wheel in the direction of rotation and thereby takes along the balance wheel part of the way by frictional engagement. The balance wheel will automatically re-start to oscillate, upon its release by the stop portion of the spring lever because its hairspring has been wound up slightly by engagement with the stop portion.

In order to stop the balance wheel assembly on an electric timepiece at the desired position, at which position the current from the battery to the magnetic coil is interrupted, it is advantageous if the balance wheel has a stop pin or a projection on its periphery against which the stop portion of the spring lever can strike as the balance wheel swings.

The stop pin on the balance wheel may be disposed at any optional point of same. If, instead of a balance wheel, another type of vibrator or oscillator is used, the stop may be disposed thereon at any desired position. If desired, the stop may readily be provided on another section of the balance wheel assembly, for example, on a disc mounted on the balance wheel staff.

Further features and advantages of the present invention will be apparent from the following description of preferred embodiments thereof, given with reference to the accompanying drawings in which:—

Figure 1 is a schematic top plan view of a first embodiment of the present invention, which embodiment is a mechanically driven timepiece, wherein the stem is in its first inner position;

Figure 2 is a partially open front view of Figure 1;

Figure 3 is a plan view corresponding to Figure 1 with the stem in its second outer position;

Figure 4 is a schematic plan view of a second embodiment of the present invention, which embodiment is an electrically driven timepiece whose stem is shown in its first inner position;

Figure 5 is a partially open front view of Figure 4; and

Figure 6 is a plan view corresponding to Figure 4 but with its stem in the second outer position.

In the first embodiment of the present invention shown in Figures 1 to 3, a mechanic-

ally driven watch or other timepiece is schematically represented. The various wheels are shown, but details concerning their mountings are omitted as conventional watch construction may be utilized. The movement is likewise only schematically represented and designated by 10 as a whole. In movement 10 there is mounted a winding-up and hand-setting stem (staff) 12, hereinafter referred to as the stem. Stem 12 is shiftable relative to the watch case from a first inner position, as shown in Figure 1, to an outer position as in Figure 3. A setting lever 14 coacts with the stem 12, the lever 14 being mounted in the movement by means of setting lever screw 16. Lever 14 has a nose 18 near its free end. Setting lever 14 has an arm 20 which engages an annular recess in stem 12 so that the lever is correspondingly pivoted by the shifting of the stem 12.

A winding pinion 22 is mounted in movement 10 so that it can be rotated by means of stem 12. Pinion 22 meshes with a large cock wheel 24 rotatably mounted in a cock 26, and cock 26 is a turnable plate pivoted on a staff 28.

A small cock wheel 30 is also rotatably mounted on said cock 26 so that wheel 30 meshes with large cock wheel 24 and also, at times, meshes with a going barrel 32 housing the mainspring. A second small cock wheel 34 is likewise rotatably disposed on cock 26 so that, in the position shown in Figure 1, it meshes only with the large cock wheel 24. As will be explained in detail below, cock wheel 34 can be brought into engagement with a minute wheel 36. A pinion 38, fixed to the same staff which carries minute wheel 36, drives an hour wheel 40 which, in turn, carries hour tube 42. A conventional minute tube (not shown) carries the minute hand and meshes with minute wheel 36.

A balance wheel assembly 44 has a balance wheel staff 46 mounted in the movement in jewel bearings 48 and 50. The balance staff 46 carries a balance member generally indicated by 52 comprising a balance wheel 54. The oscillatory swinging action of the balance wheel as the time standard in a timepiece is known and for this reason is not described here.

A multipurpose spring member 56 is anchored in the movement at slot 58. The member 56 comprises a free spring lever having, as integral sections (portions) thereof, a coupling section 62 adjacent slot anchorage 58 and, in continuation thereof, up to the free end, a spring lever arcuate section 64. At its free end the arcuate section has a stop portion 66 that is bent downwardly parallel to the balance staff, as illustrated in Figure 2.

The spring member 56 contacts a blocking member 68 formed by a downward extending arm of cock 26 and, as shown in Figure 1, normally pivotally biases said cock counter-

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clockwise. In the cock position shown in Figure 1, the small cock wheel 30 is urged into mesh with going barrel 32 by spring lever 60. The blocking member 68 also acts against the nose 18 of setting lever 14.

The mode of operation will now be described having reference to Figures 1 to 3.

As already stated, in the position of the stem shown in Figures 1 and 2, the small cock wheel 30 is in mesh with barrel cover 32. When stem 12 is turned, by the user, the train of gears comprised of winding pinion 22, the large cock wheel 24, the small cock wheel 30 and going barrel 32, will rotate with the ultimate effect of winding up the mainspring. The spring member 56 endeavours to constantly urge the cock into the position shown in Figures 1 and 2. The spring lever arcuate section 64 is thus out of contact with the balance wheel assembly 44.

Now if, as shown in Figure 3, the stem 12 is drawn outwardly to the second outer position, setting lever 14 is pivoted clockwise so that the nose 18 of the setting lever acting against the blocking member 68 pushes the cock into a new position in which the small cock wheel 34 meshes with the minute wheel 36. Therefore, upon the user turning the stem 12 and so rotating winding pinion 22 and the large cock wheel 24, the hands can be set.

By pivoting the blocking member 68 the entire spring member 56 is deflected so that now the stop portion 66 is pressed against the balance wheel 54, whereby the balance assembly comes to a standstill.

By pushing in the stem into its inner position shown in Figure 1, a transverse movement towards the balance staff results, causing therewith a gliding motion of stop portion 66 along the balance wheel 54. The balance wheel 54 is frictionally engaged for a short distance, whereby the balance wheel is again set into swinging motion. By this means the timepiece is automatically started up again.

Insofar as identical components are illustrated in the embodiment shown in Figures 4 to 6, they have the same reference numerals as in the first embodiment. The cock, too, although it is somewhat modified, has, for simplicity, the same reference numeral.

In contrast with the first embodiment, the cock 26 in this second embodiment does not have a small cock wheel 30, as this timepiece is not mechanically driven. In place of a mainspring, the movement 10 has a battery 70 with which a connecting spring 72 coacts, the spring 72 being secured to an insulating pad 74 and being electrically connected to a contact spring 76 which coacts with contact pin 78 on the balance wheel 54. The balance wheel 54 carries a flat coil 80 of fine wire and a stop projection 82 (a stop) is disposed on the periphery of the balance wheel 54.

The multipurpose spring member 90 is

anchored in the movement at groove 92 and consists of a spring lever having a coupling section 96 and a spring lever arcuate section 98. The arcuate section 98 carries a stop portion 100 which, as shown in Figure 5, is bent downward and parallel to balance staff 46. The multipurpose spring in this case is a flat spring with a configuration such that the coupling section 96 which extends beyond the blocking member 68 has a larger cross-section than does the spring lever arcuate section 98.

In the following, the manner of operation of the second embodiment, shown in Figures 4 to 6, is explained.

In Figure 4, the stem 12 is shown in its inner position where the small cock wheel 34 is out of mesh with the minute wheel 36. The multipurpose spring 90 endeavours to urge cock 26 into the position shown in Figure 4 so that the spring lever arcuate section 98 is out of contact with the balance assembly, i.e. out of contact with the balance wheel 54.

Now if the stem 12 is pulled out to its outer position as shown in Figure 6, the hands may be set as in the first embodiment. The multipurpose spring 90 is deflected in such a way that the stop portion 100 comes close to balance wheel 54 or touches the same, but without stopping the balance assembly. The balance assembly continues turning until stop projection 82 rotates counter-clockwise and reaches stop portion 100. The stop portion 100 then engages stop projection 82 and thereby brings the balance wheel 54 to a stop at a predetermined position in which the contact spring 76 is out of contact with contact pin 78, which breaks the electrical circuit to the coil 80.

When the stem 12 is pushed in, then, in known manner, the balance wheel 54, and with it the entire movement, can run again because the balance wheel 54 has not only been stopped out of contact with contact spring 76 but, also, in such a position that it is set into swinging motion by the hairspring (not shown).

The spring member may be constructed from two originally separate spring pieces having different spring forces which are welded or otherwise joined together. Alternatively, the spring member may be constructed from a uniform one-piece spring lever and then the stopping section may be machined or otherwise formed to be substantially smaller in cross-section than the coupling section.

Although the present invention has been described in connection with a balance wheel assembly as the time regulator or standard, it will be understood that other types of oscillators may be alternatively employed. For example, the oscillator may move only axially and not about an axis. Furthermore, the balance wheel assembly may be synchronized by another oscillator, for example, a quartz

crystal electronic oscillator or a high rate mechanical vibrator.

WHAT WE CLAIM IS:—

- 5 1. A horological movement including an oscillator, a hand-setting stem which is axially shiftable between a first inner position relative to said movement and a second outer position, a cock pivotally mounted for movement from a first position into a second hand-setting position in response to axial shifting of the stem into its outer position, and a resilient member, said resilient member having a coupling section which biases said cock towards its first position and a spring lever arcuate section which in the outer position of the stem acts against the oscillator to stop the oscillator, wherein said resilient member has one portion fixed to said movement and is in contact with and movable by said cock.
- 20 2. A horological movement according to Claim 1 wherein said oscillator is a balance wheel assembly and wherein said spring lever arcuate section has a stop portion which contacts the balance wheel assembly and stops it in the outer position of said stem.
- 25 3. A horological movement according to Claim 2 wherein the stop portion is the free end of said spring lever arcuate section.
- 30 4. A horological movement according to Claim 2 or Claim 3 wherein said stop portion is bent from the general direction of the resilient member which is perpendicular to the balance staff in a direction parallel to said balance staff.
- 35 5. A horological movement according to any one of Claims 2 to 4, wherein said stop portion in its movement into its starting position moves along the periphery of said balance wheel assembly in the direction of rotation and thereby takes along said balance wheel assembly part of the way by frictional engagement.
- 40 6. A horological movement according to any one of Claims 2 to 4, wherein said balance wheel assembly has a stop member and said stop portion strikes against said stop member of said balance wheel assembly in the outer position of said stem.
- 50 7. A horological movement according to any of the preceding claims, wherein the coupling section that coacts with said cock is fixedly attached at one end to the movement and has a relatively strong spring force and the spring lever arcuate section that coacts with the oscillator has a relatively weak spring force.
- 55 8. A horological movement according to Claim 7, wherein said spring lever arcuate section has a substantially smaller cross-section than said coupling section.
- 60 9. A horological movement according to any of the preceding claims, wherein said resilient member is an integral spring.
10. A horological movement according to

any of the preceding claims, wherein the said resilient member is a suitably bent flat spring.

11. A horological movement according to any of the preceding claims, wherein said resilient member is a suitably bent wire spring.

12. A horological movement according to Claim 7 or Claim 8 wherein said spring is composed of two originally separate pieces which are joined together.

13. A horological movement according to Claim 9 wherein a middle section of said spring acts upon said cock.

14. A mechanical watch movement including a base plate, rotatable display means, a mainspring and a going barrel, a cock pivotally mounted on the plate and carrying three rotatable gear wheels consisting of a centre wheel in mesh with two end wheels, a dial train drive consisting of a plurality of rotatable gear wheels to rotate said display means and including a minute wheel, a balance wheel assembly rotatably mounted on said plate for oscillatory movement, a hand-setting stem axially and slidably mounted on said plate and carrying a gear which is in mesh with the centre wheel of said cock, and an integral multi-purpose spring fixed at only one of its ends to said plate, said spring acting upon said cock to normally urge one of its end wheels into mesh with said going barrel, said cock being pivotally displaced by axial movement of said stem from an inner to an outer position relative to said watch movement to bring the other end wheel of said cock into mesh with said minute wheel, said spring contacting and being actuated by said cock to stop and hold said balance wheel assembly when the other end wheel of said cock is in mesh with said minute wheel.

15. An electrical watch movement including a base plate, rotatable display means, battery terminals to contact a battery positioned within the movement, a balance wheel assembly including a balance wheel fixed to a staff, said staff being rotatably mounted on said base plate for oscillatory movement, a coil fixed to said balance wheel, a stop member fixed to said balance wheel assembly, a cock pivotally fixed to said base plate and carrying two rotatable meshing geared wheels, a stem mounted on said base plate for rotational and axial movement relative to said movement, a gear fixed to said stem and meshing with the first wheel carried by said cock, a dial train drive consisting of a plurality of geared wheels rotatably fixed on said base plate and including a minute wheel, said cock being pivotally displaced by axial movement of said stem from an inner to an outer position relative to said watch movement to bring the second wheel carried by said cock into mesh with said minute wheel, an elongated multi-purpose spring fixed only at one end and contacting said cock to bias said cock against such displacement, said spring having

crystal electronic oscillator or a high rate mechanical vibrator.

WHAT WE CLAIM IS:—

1. A horological movement including an oscillator, a hand-setting stem which is axially shiftable between a first inner position relative to said movement and a second outer position, a cock pivotally mounted for movement from a first position into a second hand-setting position in response to axial shifting of the stem into its outer position, and a resilient member, said resilient member having a coupling section which biases said cock towards its first position and a spring lever arcuate section which in the outer position of the stem acts against the oscillator to stop the oscillator, wherein said resilient member has one portion fixed to said movement and is in contact with and movable by said cock.
2. A horological movement according to Claim 1 wherein said oscillator is a balance wheel assembly and wherein said spring lever arcuate section has a stop portion which contacts the balance wheel assembly and stops it in the outer position of said stem.
3. A horological movement according to Claim 2 wherein the stop portion is the free end of said spring lever arcuate section.
4. A horological movement according to Claim 2 or Claim 3 wherein said stop portion is bent from the general direction of the resilient member which is perpendicular to the balance staff in a direction parallel to said balance staff.
5. A horological movement according to any one of Claims 2 to 4, wherein said stop portion in its movement into its starting position moves along the periphery of said balance wheel assembly in the direction of rotation and thereby takes along said balance wheel assembly part of the way by frictional engagement.
6. A horological movement according to any one of Claims 2 to 4, wherein said balance wheel assembly has a stop member and said stop portion strikes against said stop member of said balance wheel assembly in the outer position of said stem.
7. A horological movement according to any of the preceding claims, wherein the coupling section that coacts with said cock is fixedly attached at one end to the movement and has a relatively strong spring force and the spring lever arcuate section that coacts with the oscillator has a relatively weak spring force.
8. A horological movement according to Claim 7, wherein said spring lever arcuate section has a substantially smaller cross-section than said coupling section.
9. A horological movement according to any of the preceding claims, wherein said resilient member is an integral spring.
10. A horological movement according to

any of the preceding claims, wherein the said resilient member is a suitably bent flat spring.

11. A horological movement according to any of the preceding claims, wherein said resilient member is a suitably bent wire spring.

12. A horological movement according to Claim 7 or Claim 8 wherein said spring is composed of two originally separate pieces which are joined together.

13. A horological movement according to Claim 9 wherein a middle section of said spring acts upon said cock.

14. A mechanical watch movement including a base plate, rotatable display means, a mainspring and a going barrel, a cock pivotally mounted on the plate and carrying three rotatable gear wheels consisting of a centre wheel in mesh with two end wheels, a dial train drive consisting of a plurality of rotatable gear wheels to rotate said display means and including a minute wheel, a balance wheel assembly rotatably mounted on said plate for oscillatory movement, a hand-setting stem axially and slidably mounted on said plate and carrying a gear which is in mesh with the centre wheel of said cock, and an integral multi-purpose spring fixed at only one of its ends to said plate, said spring acting upon said cock to normally urge one of its end wheels into mesh with said going barrel, said cock being pivotally displaced by axial movement of said stem from an inner to an outer position relative to said watch movement to bring the other end wheel of said cock into mesh with said minute wheel, said spring contacting and being actuated by said cock to stop and hold said balance wheel assembly when the other end wheel of said cock is in mesh with said minute wheel.

15. An electrical watch movement including a base plate, rotatable display means, battery terminals to contact a battery positioned within the movement, a balance wheel assembly including a balance wheel fixed to a staff, said staff being rotatably mounted on said base plate for oscillatory movement, a coil fixed to said balance wheel, a stop member fixed to said balance wheel assembly, a cock pivotally fixed to said base plate and carrying two rotatable meshing geared wheels, a stem mounted on said base plate for rotational and axial movement relative to said movement, a gear fixed to said stem and meshing with the first wheel carried by said cock, a dial train drive consisting of a plurality of geared wheels rotatably fixed on said base plate and including a minute wheel, said cock being pivotally displaced by axial movement of said stem from an inner to an outer position relative to said watch movement to bring the second wheel carried by said cock into mesh with said minute wheel, an elongated multi-purpose spring fixed only at one end and contacting said cock to bias said cock against such displacement, said spring having



a stop portion which holds said stop member upon actuation of said stem to its outer axial position.

- 5 16. A horological movement substantially as hereinbefore described with reference to Figures 1 to 3 or Figures 4 to 6 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1975.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from
which copies may be obtained.

