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DRAWINGS ATTACHED

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(54) HAIRSPRING AND REGULATOR

(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 a hairspring regulator and a hairspring.

In many horological instruments the time base is a mechanical oscillator. The oscillator is connected to the inner end of a hairspring and the outer end of the hairspring is attached to a fixed part of the instrument, for example, a frame plate or bridge. In many mainspring driven and electric watches, the oscillator is a balance wheel fastened to a balance staff. The staff pivots in bearings or other pivot means.

The timekeeping accuracy of the instrument is dependent upon the balance wheel and its hairspring.

A problem involving the hairspring system arises from the desire that when the horological instrument is sold it should be regulated to keep accurate time. One way to obtain such an initial accurate regulation is to place a watch on a timing machine, regulate it a first time, allow it to run for a while, for example, a few hours or days, and regulate it a second time. That procedure is time-consuming, costly and may require skilled personnel. In mass production, a watch is placed on a timing machine and the watch regulator moved into its supposedly correct position. However, it has been found that the oscillator rate rapidly drifts off its setting. This rapid initial drift is possibly caused, in instruments using a curved hairspring, by a change in the effective length of the hairspring due to a change in the contact area between the hairspring and the regulator. A curved hairspring is designed to constantly lie against a wall of the regulator and not to vibrate within the regulator's opening. Possibly the hairspring initially rests on one or a few

points on the internal surface of the regulator opening; but in its first few hours or days of running it wears down those points and thereby changes the contact area between the hairspring and the regulator.

It is an objective of the present invention to provide a regulator which prevents drifting of the oscillator rate after the regulator is initially adjusted, thereby avoiding a readjustment of the regulator after its initial setting.

In accordance with the present invention there is provided a hairspring and a rotationally adjustable hairspring regulator for a horological movement, wherein the regulator has an arm a portion of which contacts the hairspring; the width as herein after defined of the contact portion being less than the width of the hairspring.

The regulator is constructed so that the part of the regulator which touches the hairspring is less wide than the width of the hairspring. The area of contact between the regulator and the hairspring is purposely made small so that the initial wearing away does not have an adverse effect. In one embodiment, the regulator arm has a flange-like portion with an opening through which the hairspring passes, and the hairspring contacts the regulator on either the radially outer or inner wall of the opening, but preferably the inner wall and the contact portion of the regulator is formed by a protrusion from the inner wall upon which protrusion the hairspring rests. In a second embodiment the wall of the opening contacted by the hairspring is formed by a pin having a contact shoulder portion of greater diameter than the rest of the pin.

The invention will now be further described with reference by way of example to the accompanying drawings which illustrate preferred embodiments of the invention incorporated in the movement of a wrist watch having a balance wheel as an oscillator. In the drawings:—

Fig. 1 is a side view, partly in cross-section, of part of the watch movement including the balance wheel, hairspring and regulator;

Fig. 2 is an enlarged side view of a portion

of a regulator comprising a first embodiment of the present invention;

Fig. 3 is an enlarged side view of a portion of a regulator comprising a second embodiment of the present invention; and

Fig. 3A is a perspective view of the regulator pin in the embodiment illustrated in Fig. 3.

Fig. 1 of the drawings shows only as much of the watch movement as is necessary to provide an understanding of the present invention; other details of the watch movement not shown may be conventional. It will, of course, be understood that the present invention is applicable to other horological instruments using a mechanical oscillator and a hairspring.

As shown in Fig. 1, the watch movement includes a balance wheel 10 which is fixed on a balance wheel staff 11. A hairspring hub 12 is also fixed on staff 11. The staff 11 pivots between pivots 13 and 14 in a frame plate 15 and a bridge 16, respectively. A hairspring 17 is connected, at its inner end, to the hub 12. The outer end of the hairspring 17 is connected as shown to the bridge by clamping means indicated generally at 18. An adjustable regulator 19 is rotatably mounted on bridge 16 about the pivot 14. The regulator 19 has a regulator arm 20 with a depending extension flange portion 21 having an opening 22 through which the hairspring passes.

Figs. 2 and 3 of the drawings which more particularly illustrate the embodiments of the invention show only the outer ends of the regulator arms 20 and 20a. The remainder of the regulator may be of conventional construction as exemplified in Fig. 1.

In Fig. 2, the inner wall 23 of opening 22 is the radially inner wall i.e. the wall toward the balance staff. The wall 23 includes a central integral protruding portion 24. The hairspring 17 contacts the end of protruding portion 24. The distance the protruding portion 24 protrudes is its height and its vertical distance in Fig. 2 is its width. The vertical distance (the longer side) of the hairspring is its width and the horizontal distance (the shorter side) its thickness. For example, the width of the protruding portion 24 may be .002 in. compared to a hairspring width of .010 in. In all cases the width of that protruding portion is less than the width of the hairspring, and is preferably less than one-third of the width of the hairspring.

In Figs. 3 and 3A, the regulator arm 20a terminates in a depending extension flange portion 21a having an opening 22a through which the hairspring 17a passes. A regulator pin 26 consists of a top shank portion 27, a shoulder portion 28 and a bottom shank portion 29. The pin is round in cross-section and the diameter of the shoulder portion 28 is larger than the diameter of either shank

portion. The pin 26 is secured to the regulator arm 20a and forms the inner wall of the opening 22a. The enlarged shoulder portion 28 protrudes into opening 22a and the hairspring 17a contacts that shoulder portion 28. The width of portion 28 which is the vertical dimension of the shoulder portion in Fig. 3 is again less than the width of the hairspring and preferably also is less than one-third of the width of the hairspring.

In operation with either of the embodiments, the watch is placed on a timing machine and regulated by movement of the regulator. The watch will retain its initial rate, without re-regulation in the process of its manufacture.

WHAT WE CLAIM IS:—

1. A hairspring and a rotationally adjustable hairspring regulator for a horological movement, wherein the regulator has an arm a portion of which contacts the hairspring, the width as hereinbefore defined of the contact portion being less than the width of the hairspring.

2. A hairspring and regulator according to claim 1, wherein the regulator arm has a depending flange portion having an opening through which the hairspring passes, and the said contact portion is a protrusion from a wall of the said opening.

3. A hairspring and regulator according to claim 2, wherein the width of the protrusion is less than one-third of the width of the hairspring.

4. A hairspring and regulator according to claim 1, wherein the regulator arm has a depending flange portion having an opening, a wall of the opening being formed by a pin having a shoulder portion enlarged in diameter relative to the rest of the pin, said shoulder portion comprising the said contact portion.

5. A hairspring and regulator according to claim 4, wherein the width of the shoulder portion is less than one-third of the width of the hairspring.

6. A horological movement including a frame member and a bridge, a mechanical oscillator and a hairspring and rotationally adjustable regulator according to any one of the preceding claims, wherein the hairspring is connected between the oscillator and the bridge and the regulator is rotatably mounted on the bridge.

7. A horological movement according to claim 6, wherein the mechanical oscillator includes a balance wheel and a hairspring hub fixed on a balance staff, the staff being pivoted in the frame member and the bridge.

8. A hairspring and a rotationally adjustable hairspring regulator for a horological movement, the regulator having an arm a portion of which contacts the hairspring and is arranged substantially as hereinbefore des-



of a regulator comprising a first embodiment of the present invention;

Fig. 3 is an enlarged side view of a portion of a regulator comprising a second embodiment of the present invention; and

Fig. 3A is a perspective view of the regulator pin in the embodiment illustrated in Fig. 3.

Fig. 1 of the drawings shows only as much of the watch movement as is necessary to provide an understanding of the present invention; other details of the watch movement not shown may be conventional. It will, of course, be understood that the present invention is applicable to other horological instruments using a mechanical oscillator and a hairspring.

As shown in Fig. 1, the watch movement includes a balance wheel 10 which is fixed on a balance wheel staff 11. A hairspring hub 12 is also fixed on staff 11. The staff 11 pivots between pivots 13 and 14 in a frame plate 15 and a bridge 16, respectively. A hairspring 17 is connected, at its inner end, to the hub 12. The outer end of the hairspring 17 is connected as shown to the bridge by clamping means indicated generally at 18. An adjustable regulator 19 is rotatably mounted on bridge 16 about the pivot 14. The regulator 19 has a regulator arm 20 with a depending extension flange portion 21 having an opening 22 through which the hairspring passes.

Figs. 2 and 3 of the drawings which more particularly illustrate the embodiments of the invention show only the outer ends of the regulator arms 20 and 20a. The remainder of the regulator may be of conventional construction as exemplified in Fig. 1.

In Fig. 2, the inner wall 23 of opening 22 is the radially inner wall i.e. the wall toward the balance staff. The wall 23 includes a central integral protruding portion 24. The hairspring 17 contacts the end of protruding portion 24. The distance the protruding portion 24 protrudes is its height and its vertical distance in Fig. 2 is its width. The vertical distance (the longer side) of the hairspring is its width and the horizontal distance (the shorter side) its thickness. For example, the width of the protruding portion 24 may be .002 in. compared to a hairspring width of .010 in. In all cases the width of that protruding portion is less than the width of the hairspring, and is preferably less than one-third of the width of the hairspring.

In Figs. 3 and 3A, the regulator arm 20a terminates in a depending extension flange portion 21a having an opening 22a through which the hairspring 17a passes. A regulator pin 26 consists of a top shank portion 27, a shoulder portion 28 and a bottom shank portion 29. The pin is round in cross-section and the diameter of the shoulder portion 28 is larger than the diameter of either shank

portion. The pin 26 is secured to the regulator arm 20a and forms the inner wall of the opening 22a. The enlarged shoulder portion 28 protrudes into opening 22a and the hairspring 17a contacts that shoulder portion 28. The width of portion 28 which is the vertical dimension of the shoulder portion in Fig. 3 is again less than the width of the hairspring and preferably also is less than one-third of the width of the hairspring.

In operation with either of the embodiments, the watch is placed on a timing machine and regulated by movement of the regulator. The watch will retain its initial rate, without re-regulation in the process of its manufacture.

WHAT WE CLAIM IS:—

1. A hairspring and a rotationally adjustable hairspring regulator for a horological movement, wherein the regulator has an arm a portion of which contacts the hairspring, the width as hereinbefore defined of the contact portion being less than the width of the hairspring.

2. A hairspring and regulator according to claim 1, wherein the regulator arm has a depending flange portion having an opening through which the hairspring passes, and the said contact portion is a protrusion from a wall of the said opening.

3. A hairspring and regulator according to claim 2, wherein the width of the protrusion is less than one-third of the width of the hairspring.

4. A hairspring and regulator according to claim 1, wherein the regulator arm has a depending flange portion having an opening, a wall of the opening being formed by a pin having a shoulder portion enlarged in diameter relative to the rest of the pin, said shoulder portion comprising the said contact portion.

5. A hairspring and regulator according to claim 4, wherein the width of the shoulder portion is less than one-third of the width of the hairspring.

6. A horological movement including a frame member and a bridge, a mechanical oscillator and a hairspring and rotationally adjustable regulator according to any one of the preceding claims, wherein the hairspring is connected between the oscillator and the bridge and the regulator is rotatably mounted on the bridge.

7. A horological movement according to claim 6, wherein the mechanical oscillator includes a balance wheel and a hairspring hub fixed on a balance staff, the staff being pivoted in the frame member and the bridge.

8. A hairspring and a rotationally adjustable hairspring regulator for a horological movement, the regulator having an arm a portion of which contacts the hairspring and is arranged substantially as hereinbefore des-

described with reference to Fig. 2 or Figs. 3
and 3A of the accompanying drawings.

9. A horological movement substantially as
hereinbefore described with reference to Figs.
5 1 and 2 or Figs. 1, 3 and 3A of the accom-
panying drawings.

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