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PATENT SPECIFICATION ¹² (11) 1249 961

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DRAWINGS ATTACHED

- (21) Application No. 23027/70 (22) Filed 12 May 1970
- (31) Convention Application No. 827346 (32) Filed 23 May 1969 in
- (33) United States of America (US)
- (45) Complete Specification published 13 Oct. 1971
- (51) International Classification G 04 b 17/06
- (52) Index at acceptance G3T A6A



(54) IMPROVEMENTS IN HAIRSPRING REGULATION IN 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:—

10 The present invention relates to horology and more particularly to improvements in hairspring regulation.

In many horological instruments the time base is a mechanical oscillator. The oscillator is connected to one end of a hairspring and the other 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 wheel 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. For that reason great care is exercised in selecting the hairspring steel so that it is not adversely affected by temperature changes and aging.

A problem involving the hairspring system arises from the desire that when the horological instrument is sold it should be regulated so that it is an accurate timekeeper. One way to obtain such an initial accurate regulation is to place a watch on a timing machine, regulate it, allow it to run for a while, for example, a few hours or days, and regulate it a second time. This 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 by a change in the position of the hairspring relative to the regulator. 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 its position relative to the regulator. 50

It is an objective of the present invention to provide means ancillary to the 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. 55

It is a further objective of the present invention to prevent a change in timekeeping due to wear of the regulator caused by the moving and vibrating hairspring. 60

In accordance with the present invention, there is provided a horological instrument including a frame member and a bridge, a mechanical oscillator, a hairspring connected between the oscillator and the bridge and having an end fixed to the bridge, a rotationally adjustable regulator having an arm with a portion positioned to contact the hairspring, and hairspring pre-stressing means adjustably positioned to contact and exert force on that portion of the hairspring which lies between the regulator arm contact portion and the fixed end of the hairspring to press the hairspring into contact with the regulator arm contact portion. 65 70 75

The hairspring prestressing means is adjustable, and is adjusted to cause a pre-stressing of the hairspring against the contact portion of the regulator arm. In one embodiment the means is provided on a fixed part of the movement. In a second embodiment the means is connected with, or is a part of, the regulator arm. When the means is connected with, or integral with, the regulator arm, it provides a constant pre-stress to the hairspring regardless of the position of the regulator arm. 80 85

The invention will be further described by way of example with reference to the accompanying drawings which illustrate two preferred embodiments thereof. In the drawings:— 90

Fig. 1 is a side view, partly in cross-section,

of part of a horological movement and illustrating the balance wheel, hairspring and regulator;

5 Fig. 2 is an enlarged perspective view of the hairspring pre-stressing means of one embodiment of the invention; and

Fig. 3 is an enlarged perspective view of the hairspring pre-stressing means of the second embodiment of the invention.

10 The drawings show the present invention incorporated in the movement of a wrist watch, and Fig. 1 shows only as much of the watch movement as is necessary to provide an understanding of the present invention. It will, of course, be understood that the present invention is applicable to other horological instruments using an oscillator and a hairspring.

20 As shown in Fig. 1, the watch movement includes a mechanical oscillator in the form of a balance wheel 10 which is fixed on a balance wheel staff 11. The remaining details of the watch movement not shown may be conventional. A hairspring hub 12 is also fixed on staff 11. The staff 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 fixedly connected to the bridge by means of a wedge pin arrangement 18. An adjustable regulator 19 is rotatably mounted on bridge 16 about the pivot 14. The regulator 19 has a regulator arm 20 with an extension flange portion 21 having an opening 22 through which the hairspring passes.

40 As shown in Fig. 2, an adjustable hairspring pre-stressing means 23 is positioned to engage the hairspring 17 between the regulator 20 and the fixed end at the wedge pin arrangement. The means 23 is a screw head 24 having a slot 25, a shank 26 with screw threads, and a flat side 27 on the head 24. The shank 26 screws in matching threads in a hole in the bridge 16. The adjustment of the pre-stressing means is obtained by turning the head 24 until shoulder 28 of side 27 touches the hairspring 17. The shoulder 28 pre-stresses the hairspring 17, that is, it pushes the spring against the radially inner face of the opening 22. That force prevents movement of the spring relative to the regulator, thereby preventing rate drift.

55 To use the pre-stressing means 23 the head 24 is turned until it pushes the hairspring 17. The watch is placed on a timing machine and regulated by turning of the regulator 20. The watch will retain its initial

rate without re-regulation in the process of its manufacture. 60

The second embodiment of the present invention is the hairspring pre-stressing means shown in Fig. 3 in the watch movement of Fig. 1. In Fig. 3, the regulator arm 20a 65 has a flange portion 21a having an opening 22a for the hairspring 17a. A bendable arm 21b is joined with, or is integral with, the flange portion 21a at portion 29, the portion 29 being narrowed in width to permit bending. The free end 30 of arm 21b is curved inward and its end face 31 touches hairspring 17a at a point between the regulator opening 22a and the fixed end of the hairspring. 70

To prestress the hairspring, the arm 21b 75 is bent inward so that face 31 pushes the hairspring 17a against the radially inner face 32 of opening 22a. The watch is regulated by the moving arm 20a.

WHAT WE CLAIM IS:— 80

1. A horological instrument including a frame member and a bridge, a mechanical oscillator, a hairspring connected between the oscillator and the bridge and having an end fixed to the bridge, a rotationally adjustable regulator having an arm with a portion positioned to contact the hairspring, and hairspring pre-stressing means adjustably positioned to contact and exert force on that portion of the hairspring which lies between the regulator arm contact portion and the fixed end of the hairspring to press the hairspring into contact with the regulator arm contact portion. 85

2. A horological instrument according to claim 1, wherein the mechanical oscillator includes a balance wheel and a hairspring hub fixed on a balance wheel staff which is pivoted in the frame member and the bridge. 90

3. A horological instrument according to claim 1 or claim 2, wherein the hairspring pre-stressing means is positioned on the bridge. 100

4. A horological instrument according to claim 3 wherein the pre-stressing means is a screw head having a flat portion and a screw threaded shank, the shank screwing into a hole in the bridge. 105

5. A horological instrument according to claim 1 or claim 2, wherein the hairspring pre-stressing means is connected with the regulator arm. 110

6. A horological instrument according to claim 5, wherein the pre-stressing means is an arm extending from the regulator arm, said extending arm having a narrowed portion to permit bending. 115

of part of a horological movement and illustrating the balance wheel, hairspring and regulator;

5 Fig. 2 is an enlarged perspective view of the hairspring pre-stressing means of one embodiment of the invention; and

Fig. 3 is an enlarged perspective view of the hairspring pre-stressing means of the second embodiment of the invention.

10 The drawings show the present invention incorporated in the movement of a wrist watch, and Fig. 1 shows only as much of the watch movement as is necessary to provide an understanding of the present invention. It will, of course, be understood that the present invention is applicable to other horological instruments using an oscillator and a hairspring.

As shown in Fig. 1, the watch movement includes a mechanical oscillator in the form of a balance wheel 10 which is fixed on a balance wheel staff 11. The remaining details of the watch movement not shown may be conventional. A hairspring hub 12 is also fixed on staff 11. The staff 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 fixedly connected to the bridge by means of a wedge pin arrangement 18. An adjustable regulator 19 is rotatably mounted on bridge 16 about the pivot 14. The regulator 19 has a regulator arm 20 with an extension flange portion 21 having an opening 22 through which the hairspring passes.

As shown in Fig. 2, an adjustable hairspring pre-stressing means 23 is positioned to engage the hairspring 17 between the regulator 20 and the fixed end at the wedge pin arrangement. The means 23 is a screw head 24 having a slot 25, a shank 26 with screw threads, and a flat side 27 on the head 24. The shank 26 screws in matching threads in a hole in the bridge 16. The adjustment of the pre-stressing means is obtained by turning the head 24 until shoulder 28 of side 27 touches the hairspring 17. The shoulder 28 pre-stresses the hairspring 17, that is, it pushes the spring against the radially inner face of the opening 22. That force prevents movement of the spring relative to the regulator, thereby preventing rate drift.

55 To use the pre-stressing means 23 the head 24 is turned until it pushes the hairspring 17. The watch is placed on a timing machine and regulated by turning of the regulator 20. The watch will retain its initial

rate without re-regulation in the process of its manufacture.

The second embodiment of the present invention is the hairspring pre-stressing means shown in Fig. 3 in the watch movement of Fig. 1. In Fig. 3, the regulator arm 20a has a flange portion 21a having an opening 22a for the hairspring 17a. A bendable arm 21b is joined with, or is integral with, the flange portion 21a at portion 29, the portion 29 being narrowed in width to permit bending. The free end 30 of arm 21b is curved inward and its end face 31 touches hairspring 17a at a point between the regulator opening 22a and the fixed end of the hairspring.

To prestress the hairspring, the arm 21b is bent inward so that face 31 pushes the hairspring 17a against the radially inner face 32 of opening 22a. The watch is regulated by the moving arm 20a.

WHAT WE CLAIM IS:—

1. A horological instrument including a frame member and a bridge, a mechanical oscillator, a hairspring connected between the oscillator and the bridge and having an end fixed to the bridge, a rotationally adjustable regulator having an arm with a portion positioned to contact the hairspring, and hairspring pre-stressing means adjustably positioned to contact and exert force on that portion of the hairspring which lies between the regulator arm contact portion and the fixed end of the hairspring to press the hairspring into contact with the regulator arm contact portion.

2. A horological instrument according to claim 1, wherein the mechanical oscillator includes a balance wheel and a hairspring hub fixed on a balance wheel staff which is pivoted in the frame member and the bridge.

3. A horological instrument according to claim 1 or claim 2, wherein the hairspring pre-stressing means is positioned on the bridge.

4. A horological instrument according to claim 3 wherein the pre-stressing means is a screw head having a flat portion and a screw threaded shank, the shank screwing into a hole in the bridge.

5. A horological instrument according to claim 1 or claim 2, wherein the hairspring pre-stressing means is connected with the regulator arm.

6. A horological instrument according to claim 5, wherein the pre-stressing means is an arm extending from the regulator arm, said extending arm having a narrowed portion to permit bending.



7. A horological instrument substantially as hereinbefore described with reference to Figs. 1 and 2 or Figs. 1 and 3 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1971.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from
which copies may be obtained.

