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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Adjustable Horological Balance Bridge

We, THE UNITED STATES TIME CORPORATION, a Corporation organized under the laws of the State of Connecticut, United States of America, of Waterbury, 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 an adjustable balance bridge for horological instruments.

The timekeeping of a horological instrument is usually dependent upon an oscillatory regulating member. In a watch, the oscillatory member is usually a balance wheel which is fixed to a balance wheel staff. The balance wheel staff is pivoted between two supports, usually between a frame plate and a balance bridge connected to a frame plate. The balance wheel staff usually rotates in jewelled bearings which provide a bearing surface for rotation and restrict the axial motion of the staff. The balance wheel is caused to oscillate by the power of a main-spring, an electric battery, or other power sources.

It is important that the bearings of the balance wheel staff be axially adjustable. If the balance wheel staff has too much axial play, i.e., if the staff is free to move too far axially, it may cause escapement failures, position errors in the watch rate, and the bearing or the staff may be injured if the watch is subjected to shocks. If the staff does not have sufficient axial play, the balance wheel may not be able to swing with a sufficiently large oscillation for good time-keeping and power may be wasted.

It has been a conventional practice in watchmaking to provide that one of the members carrying a balance staff jewel may be axially adjustable. The adjustment should be able to be changed so that one or more adjust-

ments may be made at the factory and additional adjustments may be made, if necessary, by repair-men. The adjustable member is called the balance staff bridge and its axial adjustment is often referred to as an end-shake adjustment.

Many types of balance bridge end-shake adjustment arrangements have been proposed. For example, an inexpensive balance staff bridge may include a simple nut and screw arrangement. However, the watchmaker or watch repairer may injure one of the jewels by turning the screw too far. The screw may also be rotated, when the watch is worn, by vibrations and shocks, causing the loss of the balance bridge adjustment.

Some balance bridges in watches have been provided with a "positive" adjustment. A positive adjustment is a mechanism which locks the balance bridge in position after it has been adjusted. However, such positive mechanisms have been relatively expensive, difficult to manufacture, and required additional parts and assembly.

It is the object of the present invention to provide a balance bridge which is repeatedly adjustable; which may be positively locked in position after its adjustment; which is relatively inexpensive to manufacture; which requires relatively few parts; and which is relatively simple for the watchmaker or watch repairer to adjust.

In accordance with the present invention, there is provided a balance wheel and adjustable bridge assembly for a horological instrument, comprising a balance wheel mounted on a staff, a frame member carrying a first pivot for said staff, a bridge spaced from said frame member and carrying a second pivot for said staff, and means including a screw adjustably connecting said bridge and said frame member and adapted to axially adjust an end of said bridge relative to said frame member, wherein said bridges includes at

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least one integral foot to at least partly space said bridge from said frame member.

5 In a preferred embodiment the balance bridge construction includes three particular measures. First, the balance bridge is spaced away from the frame member or a spacing member on the frame member by the one or more integral feet as mentioned. Secondly, the centre portion of the balance bridge is thinner than its ends, to provide flexibility. 10 Thirdly, the second or bridge pivot is located in the balance bridge at one side and off-set from a line between the adjusting screw and another end of the bridge connected to the frame member. 15

The bridge is locked in its correct position by the adjusting screw connection. The watchmaker, to adjust the bridge, turns the adjusting screw until the correct axial spacing is obtained. This locks the bridge in position due to the reactive spring force of the balance bridge. 20

Other features and advantages of the present invention will be apparent from the following detailed description by way of example of a preferred embodiment of the present invention made with reference to the accompanying drawings, wherein:— 25

Figure 1 is a top plan view of an embodiment of the present invention showing a portion of the bridge and a portion of the frame plate; and 30

Figure 2 is a side view of the embodiment of the present invention of Figure 1 taken along lines 2—2. 35

A watch or other horological instrument not further shown includes a dial plate 1 and a front frame plate 2. The frame plate 2 is the main frame plate of the instrument, but it may alternatively be a bridge member of the main frame plate. A train bridge 3 is positioned over part of the front frame plate 2. 40

A balance bridge 4 is positioned over the train bridge 3. The portion of the train bridge shown in Figure 2 acts as a spacing means to separate the balance bridge 4 from the frame plate 2. The balance bridge 4 includes a top jewel bearing assembly 5 comprising a single bearing jewel 6 having a V-shaped cavity (in cross-section) for journalling (rotation) and for thrust. Jewel 6 is mounted in a holding ring 7. The bearing assembly may, however, be of other construction. 45 50

A balance wheel 8 is fixed on a balance wheel staff 9. Balance wheel 8 is kept in oscillation by a flat spiral return spring 10. The balance wheel is impulsed from a main-spring (not shown) or carries a coil 32 which is part of an electrical motive system including a battery (not shown). One end of spring 10 is attached to the balance wheel staff hub 11 and the other end is attached, by a pin, to a flange member 12 which is fixed in a hole in the balance bridge 4. The oscillation 65

of the balance wheel 8 provides timekeeping regulation. The balance wheel staff 9 is positioned between the top bearing jewel assembly 5 and a bottom jewel 37 within the front frame plate 2. A regulator 31, having an arm and a hole 36, provides timekeeping corrections. The hole 36 of regulator 31 fits over the ring 7. 70

A first foot 13 of the balance bridge 4 is used as one of the supports for one end of the bridge. A second foot 14 is opposite the first foot 13 at one end of the balance bridge 4. The feet 13 and 14 are relatively strong and support the balance bridge 4 away from the train bridge 3. The spacing of the balance bridge 4 from the train bridge 3 by the feet 13 and 14 permits the balance bridge to move closer to the train bridge 3 upon inward, i.e., tightening, adjustment of the balance bridge. 75 80

The balance bridge 4, seen in cross-section as in Figure 2, has a raised centre portion 33. The centre portion 33 is preferably thinner than its integral end portions. The centre portion 33 contains the jewel assembly 5. The thinning of the centre portion 33 renders the centre portion relatively flexible. 85 90

An adjusting screw 20 is positioned within a hole 21 in the balance bridge 4. The screw 20 has a head with a slot 22 for turning and a shank 23 having exterior screw threads along its entire length. The screw threads screw into the threads of a hole 24 in the dial plate 1. The screw 20 may have other forms, such as having a Phillips head, or the shank may be threaded with exterior screw threads for only its bottom portion and the rest of the shank smooth. The screw shank 23, at its centre portion, is covered by a tubular pillar 34. The pillar 34, which fits within the hole 21 of the balance bridge 4, serves to locate the balance bridge during the assembly of the movement. 95 100 105

The end of the bridge 4, opposite the feet 13 and 14, is fixed. However, it will be understood that instead of one end of the bridge 4 being fixed and the other adjustable as shown in the illustrated embodiment, both ends may be made adjustable utilising two adjusting screws and feet at both ends of the bridge. 110 115

The opposite end of the balance bridge 4 is fixed as shown by being supported on a pillar 28. A screw 25, having a slot 26, is within a hole 27 (with clearance) in the balance bridge 4. The pillar 28, having a raised central portion 29, is attached to the balance bridge by the threading of screw 25 within a cavity 30 in the pillar 28. The central portion 29 fits within the hole 27 in the bridge 4 to locate the bridge before it is fastened down. 120 125

The shape of the balance bridge 4 somewhat resembles, in plan view, a triangle. The feet 13 and 14 and the adjusting screw 20 are near one vertex, the pillar screw 25 is 130

near a second vertex, and the jewel assembly 5 is near a third vertex, i.e. off-set from a line drawn between the other two vertices.

5 The bridge 4 is adjusted by turning the screw 20 until the correct axial spacing is obtained. This locks the bridge in position due to the reactive spring force of the bridge.

WHAT WE CLAIM IS:—

10 1. A balance wheel and adjustable bridge assembly for a horological instrument, comprising a balance wheel mounted on a staff a frame member carrying a first pivot for said staff, a bridge spaced from said frame member and carrying a second pivot for said staff, and means including a screw adjustably connecting said bridge and said frame member and adapted to axially adjust an end of said bridge relative to said frame member, wherein said bridge includes at least one
15 integral foot to at least partly space said bridge from said frame member.
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2. An assembly as claimed in Claim 1 wherein said bridge is thinner in cross-section at its centre portion than at its ends to
25 provide flexibility.

3. An assembly as claimed in Claim 1

or Claim 2 wherein said bridge carries the second pivot in its centre portion and said centre portion is raised relative to said frame as compared to the ends of said bridge.

30 4. An assembly as claimed in any one of the preceding claims wherein said bridge is fixed at one end and adjustable at an opposite end and carries the second pivot in its centre portion substantially mid-way from said ends and off-set from a line between said ends.
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5. An assembly as claimed in any one of Claims 1 to 3, wherein the bridge is adjustable at both ends.
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6. A balance wheel and adjustable bridge assembly substantially as hereinbefore described with reference to the accompanying drawings.

7. A horological instrument including the balance wheel and adjustable bridge assembly as claimed in any one of the preceding claims.
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- 5 The bridge 4 is adjusted by turning the screw 20 until the correct axial spacing is obtained. This locks the bridge in position due to the reactive spring force of the bridge.

WHAT WE CLAIM IS:—

- 10 1. A balance wheel and adjustable bridge assembly for a horological instrument, comprising a balance wheel mounted on a staff, a bridge spaced from said frame member and carrying a second pivot for said staff, and means including a screw adjustably connecting said bridge and said frame member and adapted to axially adjust an end of said bridge relative to said frame member, wherein said bridge includes at least one integral foot to at least partly space said bridge from said frame member.

- 25 2. An assembly as claimed in Claim 1 wherein said bridge is thinner in cross-section at its centre portion than at its ends to provide flexibility.

3. An assembly as claimed in Claim 1

or Claim 2 wherein said bridge carries the second pivot in its centre portion and said centre portion is raised relative to said frame as compared to the ends of said bridge.

4. An assembly as claimed in any one of the preceding claims wherein said bridge is fixed at one end and adjustable at an opposite end and carries the second pivot in its centre portion substantially mid-way from said ends and off-set from a line between said ends.

5. An assembly as claimed in any one of Claims 1 to 3, wherein the bridge is adjustable at both ends.

6. A balance wheel and adjustable bridge assembly substantially as hereinbefore described with reference to the accompanying drawings.

7. A horological instrument including the balance wheel and adjustable bridge assembly as claimed in any one of the preceding claims.

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