

Jan. 1, 1963

H. L. HENCHOZ
FIXING DEVICE OF THE INNER END OF A PRECISION
INSTRUMENT SPIRAL SPRING
Filed June 5, 1961

3,071,365

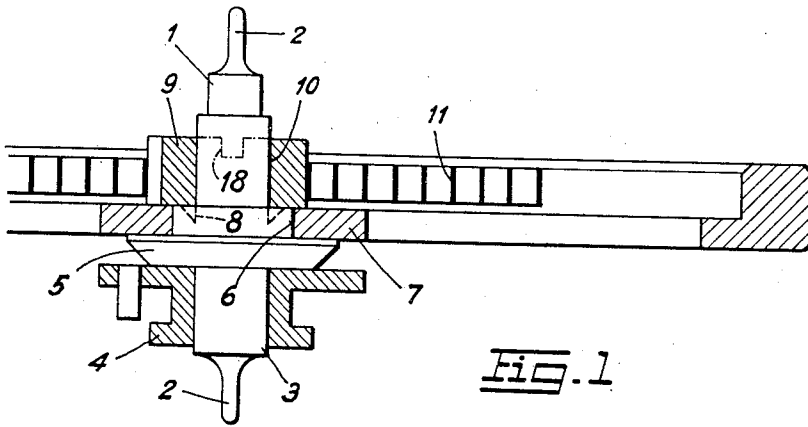


Fig. 1

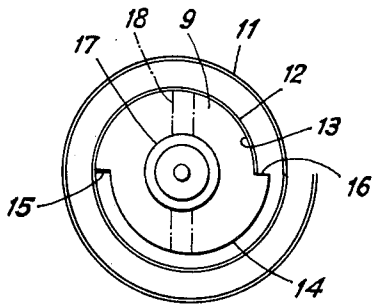


Fig. 2

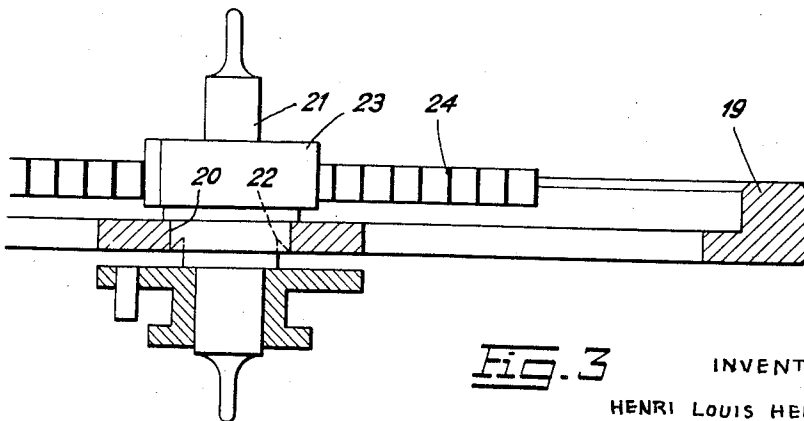


Fig. 3

INVENTOR:

HENRI LOUIS HENCHOZ

by

Mead, Browne, Schuyler & Beveridge
Attorneys

1

3,071,365

FIXING DEVICE OF THE INNER END OF A PRECISION INSTRUMENT SPIRAL SPRING

Henri Louis Henchoz, Le Locle, Switzerland, assignor to Fabrique d'Horlogerie Chs. Tissot & Fils S.A., Le Locle, Switzerland, a joint-stock company of Switzerland

Filed June 5, 1961, Ser. No. 114,991

Claims priority, application Switzerland June 3, 1960

1 Claim. (Cl. 267—1)

This invention relates to fixing devices of the inner end of a precision instrument spiral spring on a support member.

In some instances, the spiral or hair springs used in precision instruments are arranged to keep a movable unit, comprising for instance an indicator, in equilibrium in a predetermined position, against the action of a moment to be measured, said predetermined position directly depending on said moment. In other instances said spiral or hair spring are arranged in order to cause a regulating member, such as, for instance, the balance wheel of a timepiece, to oscillate with a constant frequency.

The support member to which the spiral spring inner end is fixed consists, in most of the cases and particularly in many timepieces, of a small ring or collet frictionally engaged on a shaft. The manner in which the spiral spring inner end is fixed to its support has now, as fairly known by those skilled in the art, a great influence on the function of said spring. With timepieces the isochronism of the balance wheel oscillations depends in a large measure on the manner in which the spring is fixed to its inner support. With most of the fixing devices known in the art, fixing the spiral to its inner support is quite a delicate operation which requires a great skill to be performed.

It is therefore an object of this invention to provide a fixing device which enables fixing a spiral spring on a support member in an entirely mechanical manner while realizing a fixation of high quality which can ensure a good function of the spiral spring.

A more specific object of the invention consists in forming the spiral spring support member with an outer surface portion against which the spiral spring inner end portion is fixed solely by adherence.

Still further objects of the invention will become apparent in the course of the following description.

Two embodiments of the fixing device according to the invention are represented diagrammatically and by way of example in the accompanying drawings.

In the drawings:

FIG. 1 is a part axial section of the first embodiment,

FIG. 2 is a partial plan view of some elements of the first embodiment, and

FIG. 3 is an axial section similar to that of FIG. 1 but showing the second embodiment.

FIG. 1 shows a timepiece balance wheel the shaft 1 of which is provided with a pivot 2 at both its ends. A pair of usual rollers 4 are set for a frictional fit on a supporting surface 3 of shaft 1 provided in the vicinity of the lower pivot 2. The relative axial position of rollers 4 on shaft 1 is determined by a flange or collar 5 of shaft 1 against which the larger roller 4 is abutting. The balance wheel further comprises a standardised heavy member 7 consisting of an outer ring, radial arms and a hub portion, the latter being set on a supporting portion 6 of shaft 1 extending above flange 5. Member 7 is firmly secured to shaft 1 by riveting as shown at 8. Shaft 1 still further comprises a supporting surface 10 on which a collet 9 is set. A regulating spiral spring 11 having the form of an Archimedean spiral is fixed on to collet 9.

In contradistinction to the usual spiral springs the inner

2

end portion of which is bent, the spiral spring 11 comprises an inner end portion 12 extending through an angle of 180° along the same curve as the free portion of the spiral spring, i.e. along an arc of spiral (FIG. 2). Collet 9 consists of a closed ring which has been punched out so as to form, on the one hand, two arcuate surface portions 13 and 14 the length and the curvature of which are the same as those of the spiral spring inner end portion 12 but which are radially set off with respect to one another through a distance corresponding to half the pitch of the spiral, and, on the other hand, two radial plane faces 15 and 16 extending between the surface portions 13 and 14. Each surface portion 13, 14 has thus an inner and an outer end. The surface portion 13, for instance, has its inner end delimited by the radial face 16 which extends outward from said inner end of surface portion 13 and its outer end delimited by the radial face 15 which extends inward therefrom. The spiral spring inner end portion 12 is secured along its whole length against the surface portion 13 of collet 9 so that the terminal transversal edge of the spiral spring is lying on the radial face 16 of collet 9. The spiral spring 11 can work freely from the edge formed between the surface portion 13 and the radial face 15. The first inner free coil of said spiral spring has a first half portion extending opposite the surface portion 14 of collet 9 at a distance therefrom which is equal to the height, measured in a radial direction, of the radial face 15, when spring 11 is at rest. The other half portion of said spiral spring inner coil extends opposite the end portion 12 thereof which adheres to surface portion 13 of collet 9. The distance from said second half portion to the end portion 12 is equal to the pitch of spiral spring 11. The spiral spring 11 is intended to work in such conditions that when it is wound up at most, its inner coil cannot come in contact with collet 9.

Instead of punching out the latter so as to form two arcuate surface portions each extending through an angle of 180°, said collet could also be formed with a greater number of arcuate surface portions each having a length smaller than that of portions 13, 14, and extending through an arc of a spiral whereby the spirals formed by said arcuate surface portions have the same origin, the inner end portion of spring 11 accordingly being fixed to one of said surface portions. In this case the distance between the inner free coil of the spiral spring and the other surface portions of said collet would, however, be smaller than in the former case represented in FIG. 2, in which collet 9 is provided with only two arcuate surface portions.

Collet 9 is provided with a central opening 17 adapted for setting said collet with a frictional fit on the supporting surface 10 of shaft 1. It will be observed that collet 9 is, however, not split. To enable setting it on shaft 1 in the desired conditions, opening 17 must be bored with a great precision.

It has been observed that a split ring set on to the balance shaft so as to encompass the latter with the desired strength, becomes distorted because of the resiliency of said ring and that a spiral spring fixed on to the outer surface portion of said split ring would accordingly cause the spiral spring to extend along a curve the center of which would not coincide with the balance wheel axis.

To set collet 9 round shaft 1 in the right position, i.e. in a position in which the balance wheel will be in a predetermined position around its axis, when the spiral spring 11 is at rest, collet 9 need only be gripped between its radial faces 15 and 16 by means of an appropriate forked tool and be rotated through the necessary angle. A pair of slots 18 could, however, also be provided in the upper portion of collet 9 to enable actuating the latter by means of the usual tools.

In the second embodiment (FIG. 3) a heavy member 19

3

is set on a supporting surface 20 of a shaft 21 and is secured to the latter by riveting as shown at 22. No ring is set on shaft 21 in this embodiment to serve as support for the spiral spring. In this embodiment the shaft 21 constitutes itself the support member of the spiral spring inner end. Shaft 21 is therefore integrally formed with a collar 23 extending between the upper shaft pivot and the supporting surface 20. The outer sizes of collar 23 can, of course, be the same as those of collet 9 of the first embodiment and the contour of collar 23 can also be cut so as to have the same shape as that of collet 9. The inner end of spiral spring 24 can therefore be fixed on to one outer surface portion of collar 23 having the same shape as surface portion 13 of the first embodiment.

Since the inner end of spiral spring 24 is fixed once for ever to the balance shaft 21 in this second embodiment, it is here no longer possible to adjust the resting position of the balance wheel around its axis of rotation in the same manner as in the first embodiment. The outer end of spiral spring 24 has therefore to be fixed to an anchor bolt carried by a member mounted for rotary motion around the balance wheel axis.

Instead of making collar 23 with the same sizes as collet 9, it could also be made smaller. In this case the inner end of spiral spring 24 would extend at a distance from the balance wheel axis which would be smaller than that of the inner end portion 12 of spiral spring 11 of the first embodiment.

With the first embodiment as well as with the second one different means can be resorted to, to secure the spiral spring inner end to the outer surface portion of its support member by adherence. The spiral spring can thus, for instance, be fixed to its support member by means of glue. Some glues, such as those, for instance, which harden upon heating and adding hardening means, have indeed a sufficient resistance to ensure satisfactory fixing conditions between the spiral spring and its support member. Said fixing operation can also be ensured by soldering by means of a soft material having a melting point below 200° C. However, a particularly advantageous fixing method consists in soldering the spiral spring to its support by means of supersonic vibrations. This method has, indeed, the advantage that it does not involve any raise of the temperature of the pieces fixed to one another. Said method can, moreover, be used with pieces having very small sizes. Finally, the supersonic soldering method has still the advantage that the operations required thereby can be effected in an entirely mechanical, i.e. automatic manner. To carry out this supersonic soldering method the collet 9 of the first embodiment or the shaft 21 of the second one need only be fixed rigidly to a support member capable of oscillating at high frequency and the spiral spring portion to fix to its support be

4

pressed against the surface portion of said ring or of said shaft by means of a fixed tool provided, at its end, with a thin wall portion having a form adapted to that of the outer surface portion of the spiral support member.

The fixing device according to the invention has many advantages. The sizes of the spiral spring support member can substantially be reduced with respect to the similar elements which are known as yet. In some instances an independent ring to support the spiral spring inner end portion can even be suppressed and said spring be directly fixed to the balance wheel shaft, the portion thereof adapted to receive said spring having a diameter smaller than that which an independent ring could be given to. As it is well-known to those skilled in the art, the running rate differences between the different vertical positions of the watch are the smaller, the nearer the inner free coil of the spiral spring extends from the balance wheel axis. The fixing device according to the invention thus permits improving the running of the watch. Since the spiral spring can be fixed by automatically working means to its support member, the fixing device according to the invention has still the advantage to ensure a reproducible fixation of said spring.

Although two embodiments of the invention have been described in details hereabove, it should be understood that various changes in the sizes, shape and arrangement of parts will appear obvious to those skilled in the art without departing from the spirit of the invention or sacrificing the advantages thereof.

I claim:

In combination, a support member having an outer surface portion extending around said support member from an inner end through a predetermined angle to an outer end, a first radial face on said support member extending outward through a predetermined distance from the inner end of said outer surface portion, a second radial face on said support member extending inward from the outer end of said outer surface portion, and a spiral spring having a resting position and adapted for being wound up and down elastically from said resting position, the pitch of said spiral spring thereby varying between a smallest and a largest value, said smallest value being larger than said predetermined distance, and said spiral spring having an inner end portion fixed to said outer surface portion solely by adherence.

References Cited in the file of this patent

UNITED STATES PATENTS

2,243,679	Overstrom et al. _____	May 27, 1941
2,397,400	Barwich _____	Mar. 26, 1946
2,619,933	Gordon et al. _____	Dec. 2, 1952
2,842,935	Bradley _____	July 15, 1958