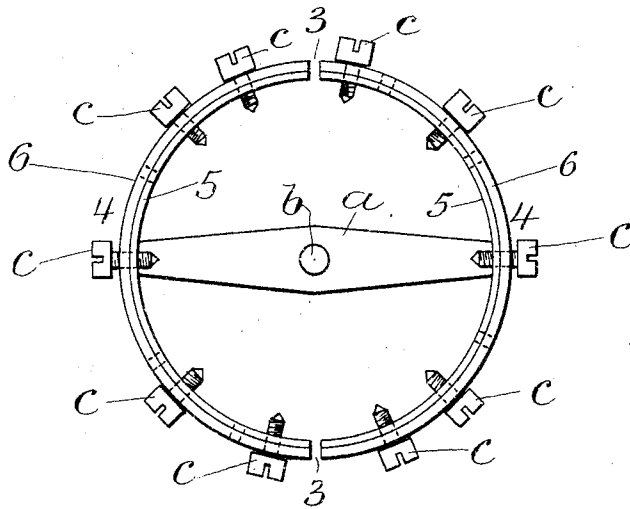


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D. H. CHURCH.
COMPENSATION BALANCE.
APPLICATION FILED AUG. 1, 1904.



Witnesses:
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UNITED STATES PATENT OFFICE.

DUANE H. CHURCH, OF NEWTON, MASSACHUSETTS.

COMPENSATION-BALANCE.

SPECIFICATION forming part of Letters Patent No. 789,004, dated May 2, 1905.

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To all whom it may concern:

Be it known that I, DUANE H. CHURCH, of Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Compensation-Balances, of which the following is a specification.

This invention relates to compensation-balances for watches and other timepieces; and it has for its object to provide a balance the segmental compensating sections of which when influenced by changes of temperature shall move their weights on lines which are substantially radial to the center of oscillation of the balance and shall be practically unaffected by centrifugal force.

Heretofore the laminated rim of an operative compensation-balance has been interrupted at points close to the ends of the rim-supporting cross-bar. Hence the free end of each segmental compensating section has been separated from the supported end by practically one-half of the circumference of the rim. The free end therefore has a movement of maximum amplitude and in a direction which is approximately tangential to the rim. This causes an approximately tangential movement of the weights and a lack of uniformity in their action and results in what is known as the "middle error." Moreover, the resiliency of the sections, due to the distance between their supported and free ends, renders them susceptible to the action of centrifugal force.

My invention consists in a compensation-balance characterized as follows: First, the continuity of the laminated rim is interrupted to form sections which are movable by thermal action and are made relatively short as compared with the sections of the ordinary operative compensation-balance above referred to, the form and arrangement of the sections being such that the movement of the balance-weights caused by changes of temperature is much more nearly radial relatively to the axis of the rim than in the said ordinary balance in which said movement is approximately tangential; secondly, the inner layer of the laminated rim is composed of a material, such as an alloy of nickel and steel,

which is practically inert under changes of temperature, the outer layer being composed of a material, such as brass, which has a relatively high coefficient of expansion and contraction. This second characteristic of my invention insures a sufficient amplitude of movement of the sections and their weights under changes of temperature to make the relatively short sections operative, the fact being that the said sections when made sufficiently short to cause approximately radial movements of the balance-weights, if provided with inner layers of steel or any other material heretofore used for this purpose, cannot be given movements of operative amplitude by thermal action.

I have found that by employing short sections, such as are formed by dividing the laminated rim to form four segmental sections of substantially uniform length, two at each side of the supporting cross-bars of the balance, and by making the inner layers of the sections of a practically inert alloy I insure a practically radial movement of the balance-weights of operative amplitude, the radial direction of movement of the weights, together with the amplitude of said movement, reducing what is known as the "middle temperature error" to a negligible quantity. The preferred inert material for the inner layers of the segmental sections is an alloy composed of nickel and steel in proportions of thirty-six per cent. of the former and sixty-four per cent. of the latter, though obviously these proportions may be changed as desired. This alloy has a coefficient of expansion and contraction which is lower than that of any other alloy or metal of which I am aware.

The second characteristic or feature of my invention—viz., the inner section layers of inert material or alloy—is not limited to the previously-described form of the sections and may be embodied in a balance the sections of which are of any suitable length and arrangement.

The accompanying drawing, forming a part of this specification, represents, on an enlarged scale, a plan view of a compensation-balance embodying my invention.

In the drawing, *a* represents the support-

ing cross-bar of a compensation-balance, the same being attached to the arbor *b* and being usually integral with the inner metal of the rim. The rim of the balance is composed, as usual, of an inner and an outer layer, said layers having different coefficients of expansion and contraction. The continuity of the rim is interrupted, so that it comprises four segmental sections, each of which is supported at one end by the cross-bar and is free at its opposite end. The sections are provided with weights *c*, which are usually the heads of screws, the threaded shanks of which are engaged with the sections. The sections are affixed rigidly to the cross-bar, the inner layers of the sections, as before said, being usually integral with the cross-bar.

In carrying out my invention I entirely interrupt the continuity of the rim at the points 3 3, which are located about midway between the ends of the cross-bar *a*. This results in the formation of four relatively short compensating sections 4 4 of substantially uniform length, there being two of these sections at each side of the cross-bar. Each section 4 is affixed to the cross-bar at its inner end and is free at its outer end. The inner layer 5 of each section is composed of a practically inert material, such as the alloy above specified. The cross-bar *a* is preferably composed of the same material and is preferably integral with the inner layers. The outer layer 6 is composed of a material or alloy having a suitably high coefficient of expansion and contraction composed of brass or an alloy, such as silver and cadmium or silver and zinc.

I claim—

1. A compensation-balance having a rim-supporting cross-bar, and a laminated weighted rim the continuity of which is entirely interrupted at a plurality of points to form segmental sections each rigidly secured to the cross-bar at its inner portion and adapted to

be moved in a substantially radial direction at its outer portion by the expansion and contraction of the rim, the inner layer of the rim being substantially inert under changes of temperature, while the outer layer has a relatively high coefficient of expansion and contraction, whereby movements of operative amplitude are imparted to the sections by thermal action.

2. A compensation-balance having a rim-supporting cross-bar, and a laminated weighted rim the continuity of which is entirely interrupted at a plurality of points to form segmental sections which are rigidly secured to the cross-bar at their inner portions, and are movable by thermal action at their outer portions, the inner layer of the rim being composed of an alloy of nickel and steel which is substantially inert under changes of temperature, while the outer layer is composed of a material or alloy such as brass, having a relatively high coefficient of expansion and contraction, substantially as and for the purposes specified.

3. A compensation-balance having a rim-supporting cross-bar, and a laminated rim the continuity of which is entirely interrupted at two points each substantially equidistant from the ends of the cross-bar, to form four segmental compensating sections of substantially uniform length, each rigidly secured at its inner portion to the cross-bar, and free to move at its outer portion, the inner layers of said sections being composed of a practically inert alloy and the outer layers of a material or alloy having a relatively high coefficient of expansion and contraction.

In testimony whereof I have affixed my signature in presence of two witnesses.

DUANE H. CHURCH.

Witnesses:

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