A. H. POTTER.

Compensation-Balance for Watches.

No. 168,583. Patented Oct. 11, 1875.

Fig: 1

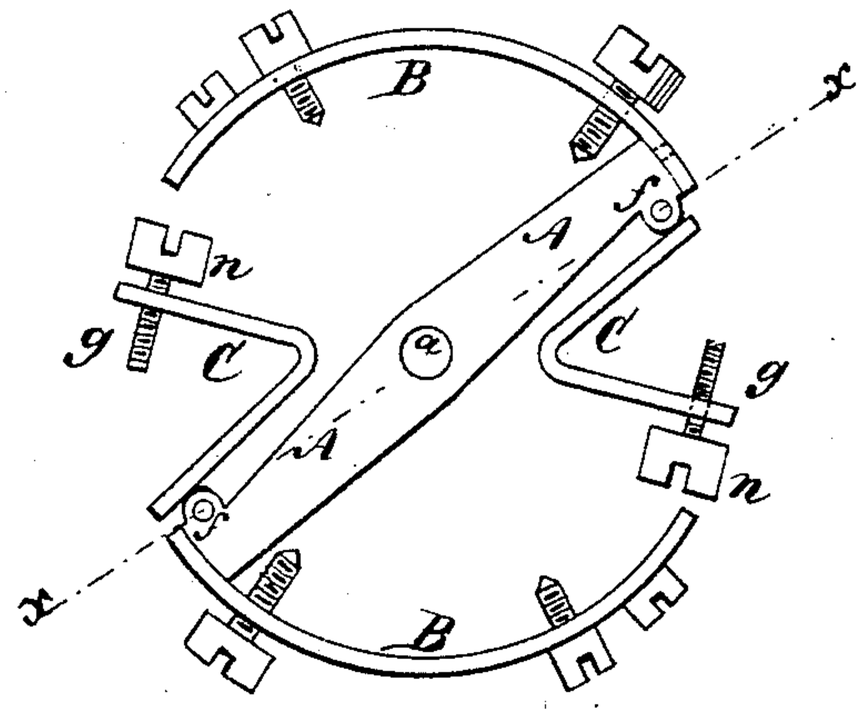


Fig: 2.

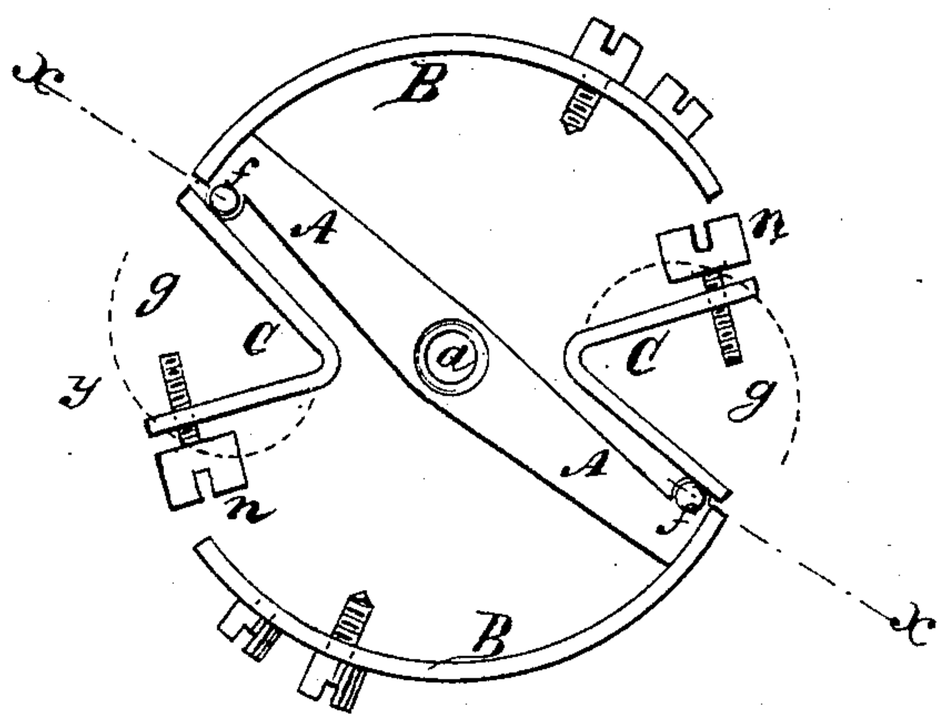
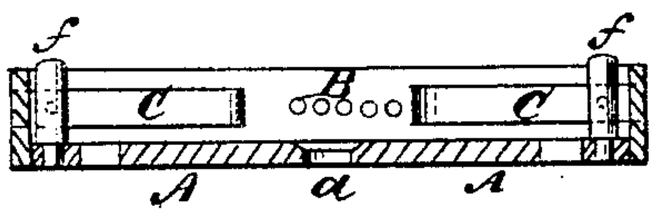


Fig: 3.



Witnesses
Henry Eichling.
H. Wells Jr.

Inventor.
Albert H. Potter
per James A Whitney
Atty.

UNITED STATES PATENT OFFICE.

ALBERT H. POTTER, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF HIS RIGHT TO JOHN H. McMILLAN, OF SAME PLACE.

IMPROVEMENT IN COMPENSATION-BALANCES FOR WATCHES.

Specification forming part of Letters Patent No. **168,583**, dated October 11, 1875; application filed August 11, 1875.

CASE B.

To all whom it may concern:

Be it known that I, ALBERT H. POTTER, of Chicago, in the county of Cook and State of Illinois, have invented an Improvement in Watches or Time-Keepers, of which the following is a specification:

In the present state of the art of watch-making it is customary to regulate the balance constructed for primary compensation, so termed, to run uniformly at two widely-separated degrees of temperature—for example, 32° and 95° Fahrenheit—but the balance regulated to uniform working at the two extremes of a given range of temperature will not possess the same uniformity of vibration at any intermediate point or degree, for the reason that, while the tension or elasticity of the balance-spring diminishes in a certain progressive ratio as the temperature increases, the moment of inertia of the balance diminishes in a much less rapid ratio, so that the compensating action is less than the action producing the irregularity.

The object of this invention is to provide a practically reliable and efficient means of compensating the irregularities caused by the discrepancy between the two ratios just referred to, and thereby to secure a balance that will vibrate uniformly at all temperatures.

The invention consists in a balance constructed with adjustably-loaded auxiliary bows, attached near the extreme ends of the balance-arms, or to any part of the arc-shaped sections of the balance, the said bows being adjustable, and so arranged that their expansion or contraction, from changes in temperature, will throw their loaded extremities radially to or from, as the case may be, the axis of the balance to the extent required to make the moment of inertia in the balance correspond to the changed tension or elasticity of the spring, whereby the desired object is effectually secured.

Figure 1 is a plan or face view, on an enlarged scale, of a watch-balance made according to my invention. Fig. 2 is an obverse view of the same. Fig. 3 is a transverse sectional view in the line *x* of Figs. 1 and 2.

A A are the balance-arms, upon the outer extremity of each of which is a curved section, B, each section being attached at one of its extremities to the outer end of one of the balance-arms A. Each section, moreover, is, as nearly as may be, arranged concentric with the axis or pivotal point *a* of the balance-arms, the two sections forming opposite circumferential portions of the balance, as a complete device, with intervals *g* between them. The sections are made in the manner usual for primary compensation, so termed—that is to say, of an outer layer of brass and an inner layer of steel, the two united in a manner well known in the art of watch manufacture.

It will be well understood that, as the brass expands more than the steel from any increase of temperature, its elongation will tend to curve the sections inward, thereby bringing their weight, together with that of their usual adjusting-screws, nearer the axis of motion *a* of the balance, and of course decreases the moment of inertia of the balance, thus providing a primary compensation for the lessened energy of the spring caused by the same rise in temperature; but as this compensating action on the part of the sections is not sufficient to fully counteract the lessened energy of the spring, as aforesaid, further compensation is essential to perfect accuracy at all temperatures, and it is for the rectification of this remaining deficiency that my invention is designed.

Upon the outer end of each of the balance-arms, opposite the inner or fixed extremity of the adjacent section B, is a bow, C, each bow being attached to the end of the arm supporting it by a pivot, *f*, or other means, permitting the adjustment of the bow with its outer or free end at a greater or less distance from the axis of the balance-arm. The pivot or other joint, whereby each bow is attached in place, is made of such snugness or tightness as to normally hold the bow in any position to which it may be turned, and yet to permit such turning or adjustment of the bows around their points of attachment to the balance-arm as may be required.

Special appliances may be added for mov-

ing the bows in such adjustment; but to all practical intents and purposes they may be readily adjusted with a pair of pliers, or the like. Each of the bows is formed, like the sections, of a layer of steel united to a layer of brass, but the layer of brass forms the inner portion of each of the bows, so that a rise of temperature, through the greater expansion of the brass, will tend, as it were, to straighten the bows. Each bow has its outer or free end loaded by a large-headed screw, *n*, which may be screwed in or out, as the case may require, to adjust the load to any desired effect or preponderance upon the aforesaid free end of the bow.

It will be observed that any change in the curvature of the bow from the straightening thereof, as just set forth, will have the effect of moving its screw or load *n* on an arc more or less concentric with the pivot *f*, by which the bow is attached to the balance-arm—in other words, in directions substantially radial to the axis of the balance as indicated by the dotted line *y* in Fig. 2. Therefore, if the bows be adjusted within the circumferential line of the balance, the straightening of the bows, as described, from an increase of temperature, will throw their free or loaded end inward toward the axis of the balance, which will diminish the moment of inertia, and thus, by supplementing or adding to the primary compensation afforded by the sections B, will provide an auxiliary compensation for the irregularity caused by the difference between the ratio of change in the energy of the spring, arising from the same change in temperature; and inasmuch as the bows may be adjusted upon their pivots or points of attachment to the balance, and inasmuch as the screws *n*, with which they are loaded, may be adjusted to give greater sweep to the free ends of the said bows, the secondary compensation arising from the action of the bows, as just hereinbefore described, may be readily made to exactly correct or supply the deficiences of the primary compensation afforded by the sections B. This adjustment of the loading-screws is secured by turning them to bring their heads at any desired distance from the extremities of the bows; or, by reversing them from the outer to the inner sides of said bows, the position of the latter, together with their loading-screws aforesaid, may be fixed in such relation with the axis of the balance that their auxiliary compensating action will exactly neutralize the irregularity caused by the difference in the two ratios, as set forth.

The bows may be made of the form represented in the drawings, or they may be made on the arc of a circle, but must not in any case exceed the one-half of a circle. Of course a diminution of temperature simply reverses the movement of the auxiliary bows, and insures the same secondary compensating action upon the balance, as in the increase of temperature.

It is to be understood, of course, that the hair or balance spring is applied to the balance-arm in the usual or in any suitable manner, and therefore calls for no special description in this connection, the relation of the balance itself to the outer portions of the watch movement being such as are well known and practiced in the art, and needing here no special explanation.

What I claim as my invention is—

The balance, constructed with the adjustable auxiliary bows C adjustably loaded, as described, substantially as and for the purpose set forth.

ALBERT H. POTTER.

Witnesses:

JAMES A. WHITNEY,

ELBERT DEARBORN.