

(No Model.)

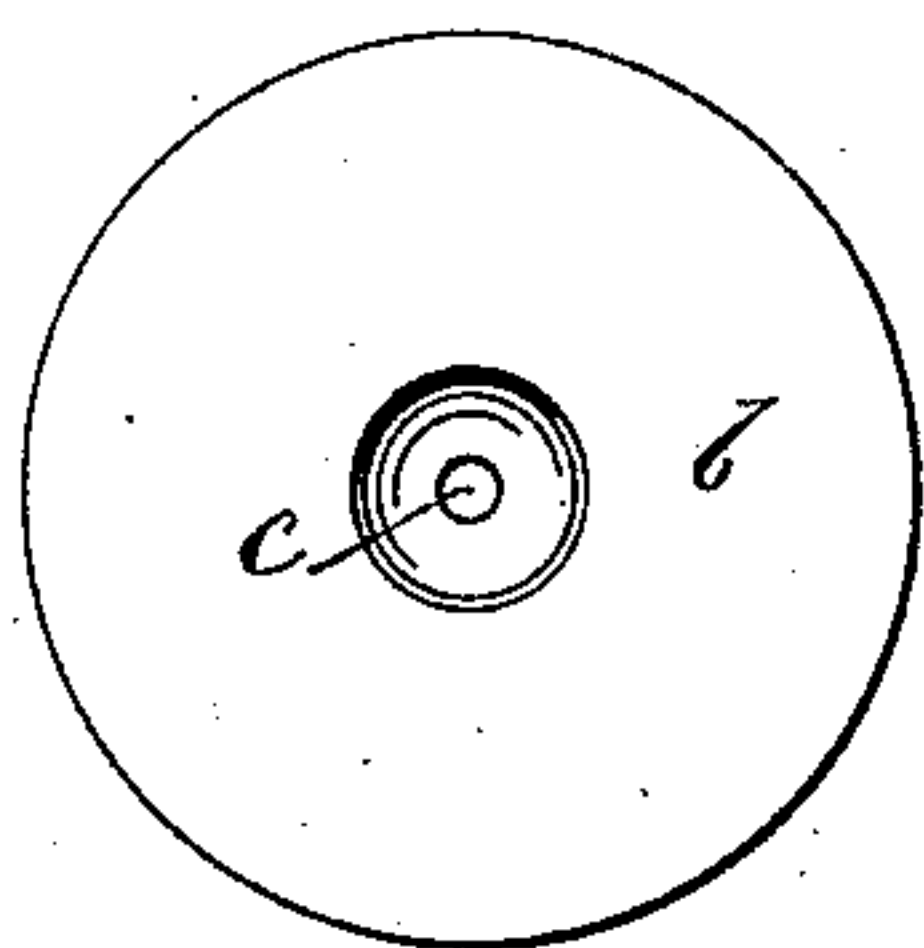
C. A. PAILLARD.

COMPENSATION BALANCE FOR WATCHES AND CHRONOMETERS.

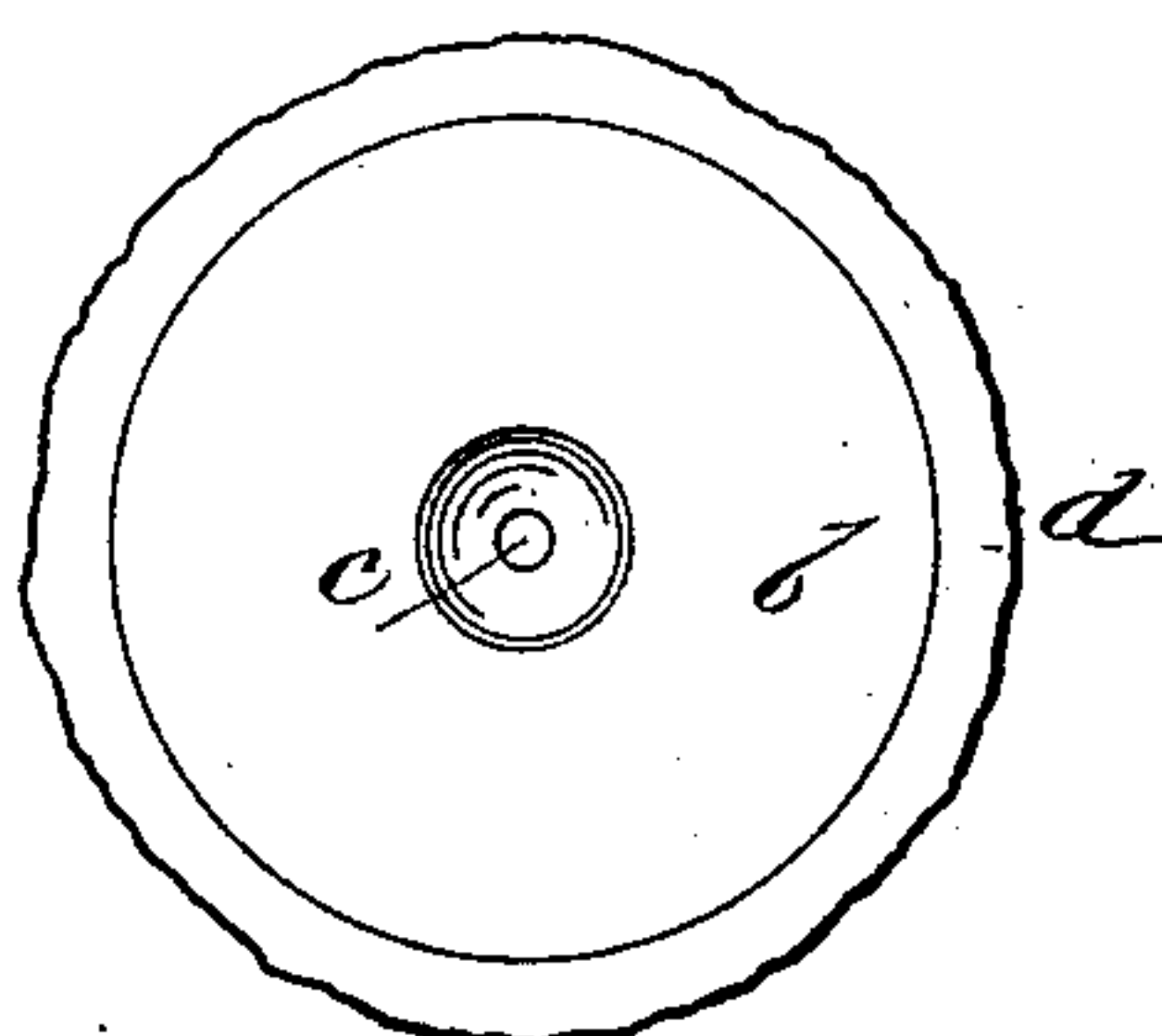
No. 359,093.

Patented Mar. 8, 1887.

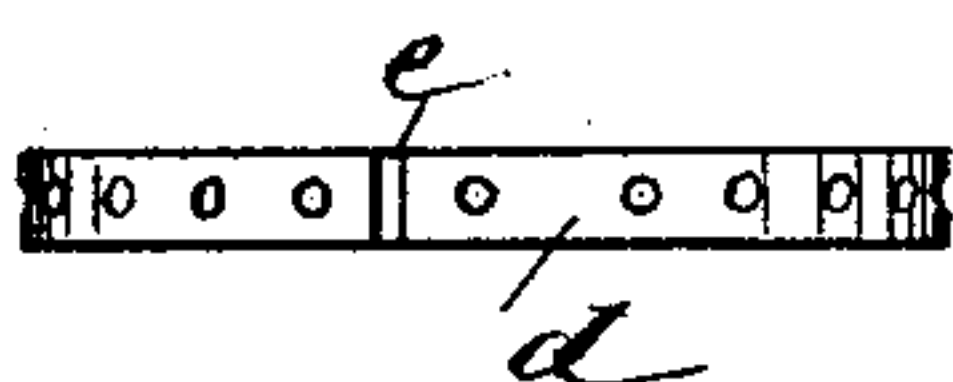
*Fig. 1*



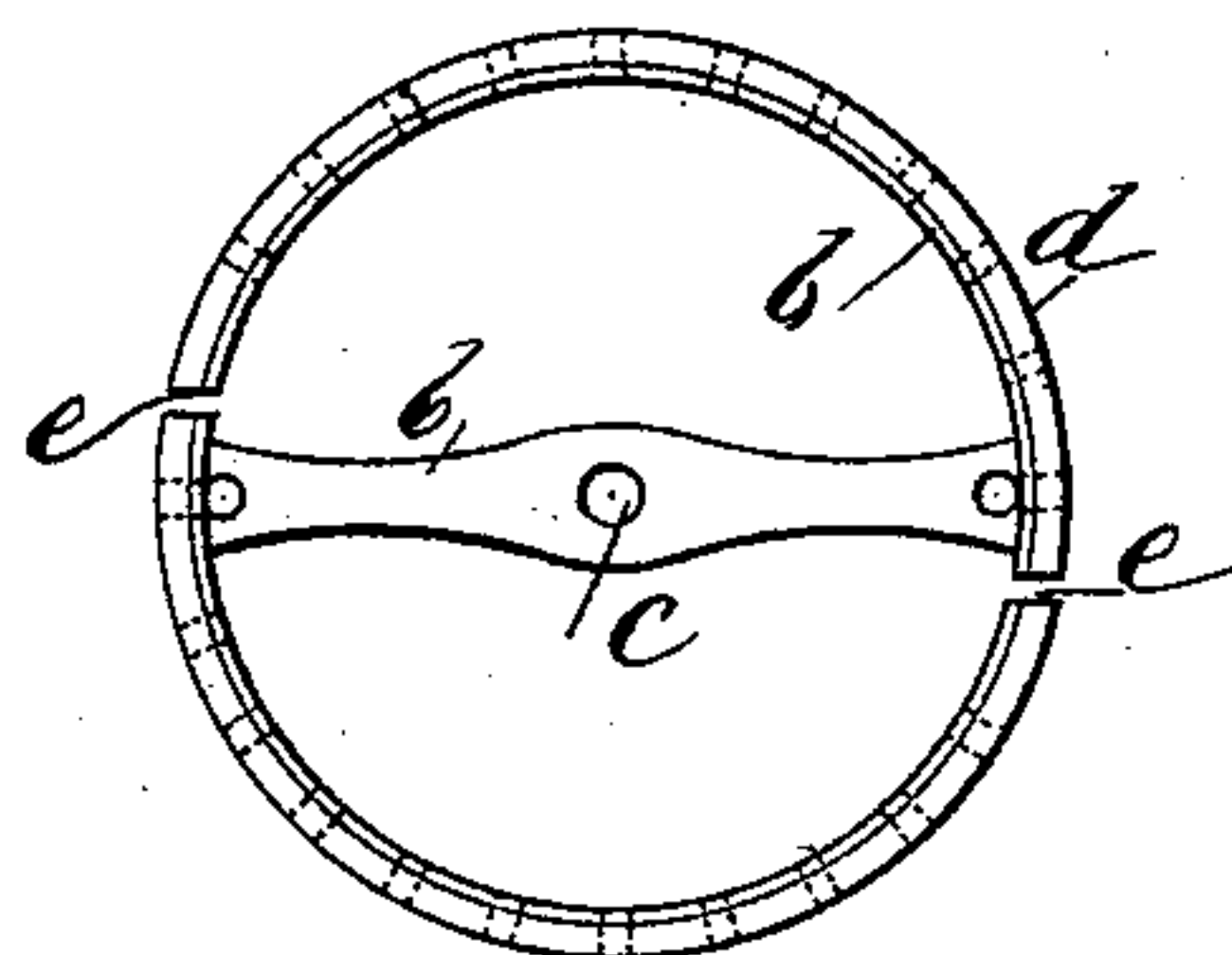
*Fig. 2*



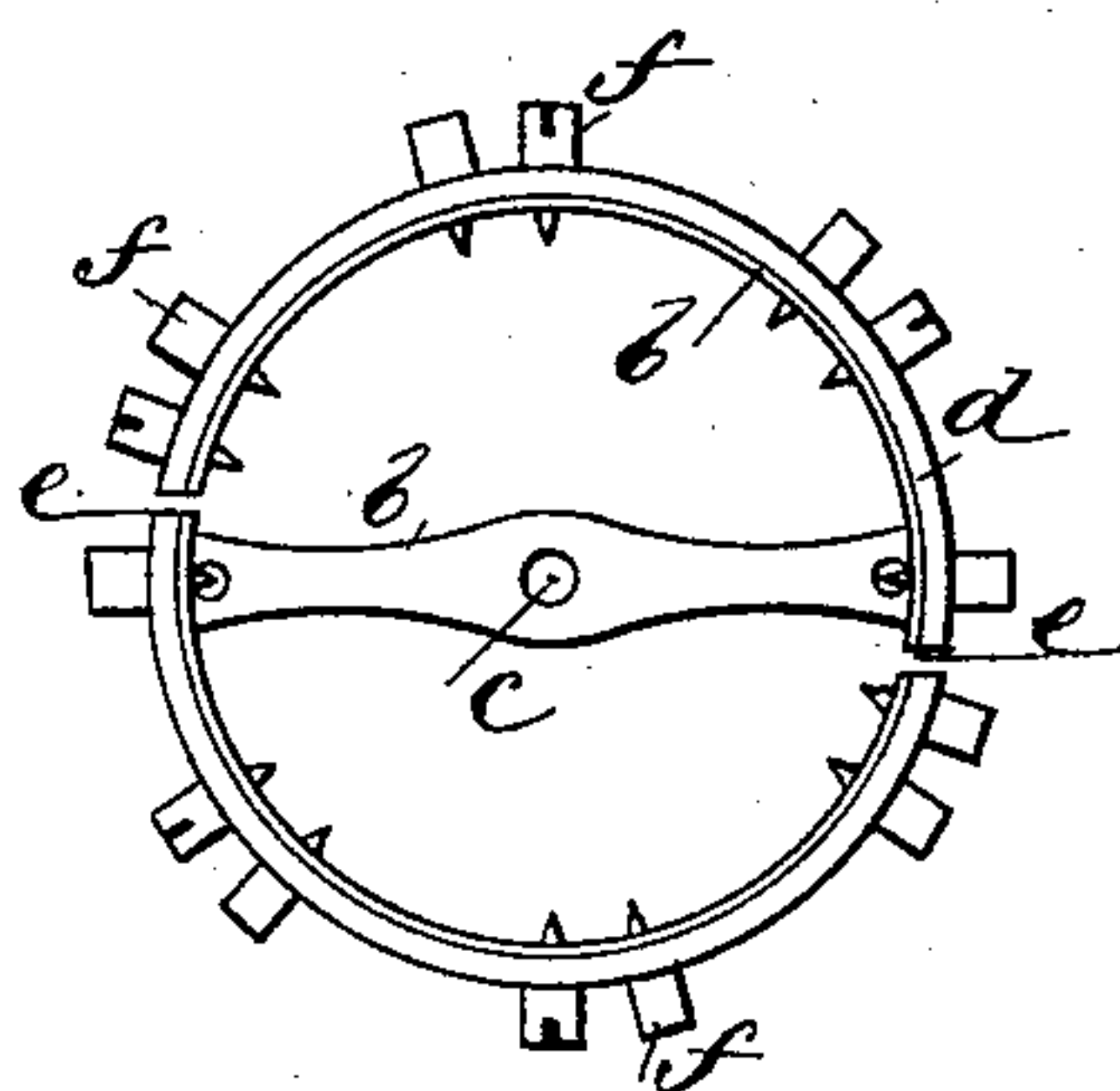
*Fig. 4*



*Fig. 3*



*Fig. 5*



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# UNITED STATES PATENT OFFICE.

CHARLES AUGUSTE PAILLARD, OF GENEVA, SWITZERLAND.

## COMPENSATION-BALANCE FOR WATCHES AND CHRONOMETERS.

SPECIFICATION forming part of Letters Patent No. 359,093, dated March 8, 1887.

Application filed June 1, 1886. Serial No. 203,855. (No model.) Patented in England July 3, 1886, No. 8,730.

*To all whom it may concern:*

Be it known that I, CHARLES AUGUSTE PAILLARD, of the city of Geneva, Switzerland, have invented a new and useful Improvement  
5 in Compensation-Balances for Watches and Chronometers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form part of this specification.

10 My invention relates to bi-metallic compensation-balances for watches and other time-pieces; and it consists in the construction, arrangement, composition, and adaptation of the parts, which will be more fully hereinafter described, and pointed out in the claims, and for  
15 which I have obtained British Patent No. 8,730, dated July 3, 1886.

The object of my invention is to produce a bi-metallic compensation-balance which will  
20 not be subject to magnetic and climatic influences to heat or cold, nor affected by or subject to rust or corrosion—in other words, a compensation-balance practically, if not entirely, non-magnetic, inoxidizable, and non-dilatable.  
25 ble.

Many attempts have been made to construct and produce such a compensation-balance as I have described in the foregoing paragraph, but without success, so far as I have been able  
30 to learn. The reason why such balances have failed is due in part to the fact that they were not properly constructed, in part to the fact that a proper differential expansion and contraction of the metals used has not been secured, and in part because the metals used  
35 were subject to magnetic and electrical, climatic, and atmospherical influences.

The difficulties heretofore experienced, as stated, in producing a compensation-balance  
40 which shall not be subject to any of the influences above enumerated I have overcome in the balance hereinafter described, and illustrated in the drawings accompanying and forming part of this application.

45 In the construction of the balance so illustrated, I employ an alloy composed of palladium and copper, or one composed of said metals as the base, and other metals, some of which are magnetic and others non-magnetic,  
50 which alloy is the subject of an application for

a patent heretofore filed by me. This alloy as compounded and made by me is non-magnetic, inoxidizable, practically non-dilatable, and not subject to climatic or atmospherical changes. In constructing said balance, I first  
55 form a thin plate of said alloy of the desired thickness by forging and hammering or in any suitable manner, and then, by the use of well-known devices having a proper die, stamp or cut out a disk from said plate of such predetermined diameter as I contemplate using,  
60 in the center of which a hole is pierced or made of suitable diameter, and then said disk is turned to a true circle, so that its diameter is the same at all points. I then fill  
65 the hole in said disk and cover its surfaces nearly to its periphery with fire-proof clay or plumbago in a plastic state, which is allowed to become dry and hard, so that the disk in the further operations of forming the  
70 balance will not be touched or affected by the other metal used except on its periphery. The disk so prepared is next placed in a suitable crucible with pieces of the other metal used to form the outer rim—such as silver,  
75 together with borax—and the crucible subjected to heat until the silver or other metal is melted, so as to flow down over the clay or plumbago covering the disk nearly to its periphery, and with the aid of the borax, the  
80 use and operation of which are well known, becomes welded and united to the periphery of the disk, forming a metallic rim thereon, the alloy of which the disk is composed and the other metal having greater or less affinity for  
85 each other.

Care and skill must be exercised in carrying out the above-mentioned operation, so that the heat in the crucible shall be only sufficient to melt the metal forming the outer rim and  
90 not the alloy of which the disk is composed.

While I prefer to follow the process described above in uniting the metal forming the outer rim to the disk, it may be so united in other ways, and I do not herein limit myself to said process.  
95

In whatever way the outside metal rim is made to adhere to the alloy disk, the excess is best removed by a lathe, and the center of the disk is hollowed out from one or both sides, so  
100



that in the center part there remains a thickness only corresponding to the thickness of the middle or cross arm of the balance which is to be cut out, care being taken to preserve a  
 5 bi-metallic rim of such dimensions that it is composed of about one-third of the palladium alloy for the inner rim to about two-thirds of the other metal for the outer rim. By partially removing the remaining central part of  
 10 the disk—as by filing, for instance—the central arm or arms for the balance - staff are formed. The boring of the screw-holes for the set-weights and the cutting of the thread in them is made by a dividing-machine. The  
 15 arm or arms of the balance, as well as the interior of the compound bi-metallic rim, are generally tempered, whereas the exterior and faces of said rim may be polished.

It is desirable, in order to give hardness, to  
 20 heat the balance in the same way as for tempering hair-springs, an art which is well known. The bi-metallic rim of the balance is then cut toward the arms and provided with its screw-weights. It is then ready for use.

25 Referring to the drawings, Figure 1 represents a face view of the blank ofinoxidizable, non-magnetic, and practically non-dilatable palladium alloy after the same has been turned into disk shape and has had the center hole  
 30 made in it to make the inner rim and inner part of the balance; Fig. 2, a face view of said disk after the same has had the silver or metal of which the outer rim of the balance is composed united to its periphery; Fig. 3, a face  
 35 view of the balance completed so as to receive the set-screws. Fig. 4 is an edge view of the same, showing the screw-holes to receive the screws or set-weights in the rim of the balance. Fig. 5 is a face view of the complete  
 40 balance.

In these figures, *b* indicates the inoxidizable and non-magnetic metal or palladium alloy of which the inner rim or inner-rim portion of the balance and arm connecting the oppo-  
 45 site sides of the rim are composed; *c*, the center hole for the balance-staff; *d*, the silver or inoxidizable and non-magnetic metal of which the outer rim or outer-rim portion of the balance is composed; *e*, the cuts in the rim of the  
 50 balance, and *f* the regulating - screws or set-weights.

A compensation-balance formed and con-

structed as herein described will not only be non-magnetic, inoxidizable, and non-dilatable, but, owing to the differential expansive- 55  
 ness of the palladium alloy and the other metal used, the rate of the movement will not be affected by climatic and atmospherical influences.

Having thus described my invention, what I 60  
 claim, and desire to secure by Letters Patent, is—

1. In a compensation-balance for time-pieces, a bi-metallic rim one plate of which is made of an alloy of palladium, substantially as de- 65  
 scribed.

2. A bi-metallic rim for compensation time-balances, one of the plates of which is of palladium alloy and the other of a non-magnetic metal of different expansibility, substantially 70  
 as described.

3. A compensation-balance for watches and other time-pieces, composed of two rim portions, one of which consists of a palladium alloy and the other of a different metal hav- 75  
 ing a different expansibility, but inoxidizable and non-magnetic, substantially as described.

4. A cut or divided bi-metallic compensation-balance for watches and other time-pieces, having a palladium-alloy inner portion and 80  
 rim and an outer-rim portion of silver or its equivalent, substantially as and for the purposes herein set forth.

5. In a compensation-balance for time-pieces, the combination, with an inoxidizable and non- 85  
 magnetic rim forming one portion of the balance, of an additional portion or rim of palladium alloy, substantially as and for the purposes herein shown and described.

6. As an improved article of manufacture, 90  
 a composite compensation-balance for time-pieces made, as herein shown and described, of independent portions, one of which is of palladium alloy and the other portion of a different inoxidizable and non-magnetic metal, as 95  
 set forth.

The foregoing specification of my invention of an improvement in compensation-balances for watches and chronometers signed by me this 15th day of February, 1886.

CHARLES AUGUSTE PAILLARD.

Witnesses:

CHARLES WILLIS WARD,  
 WILHELMINA STRUSS.