Feb. 25, 1941. G. SMITH 2,232,742

METHOD OF MAKING COMPENSATING BALANCE WHEELS AND THE LIKE

Filed Jan. 26, 1939

Fig. 1.

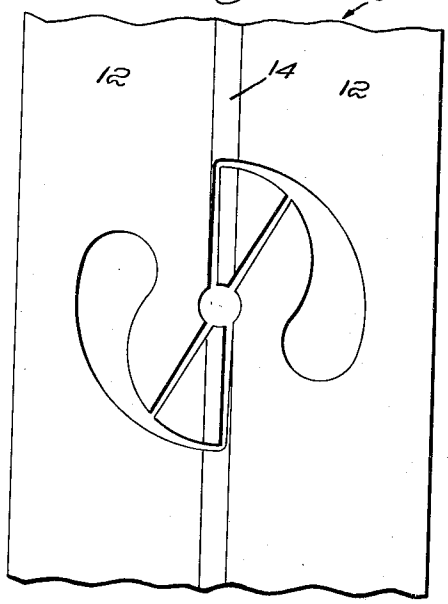



Fig. 2.

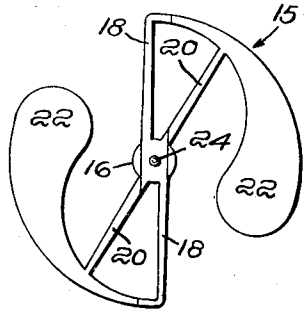



Fig. 3.

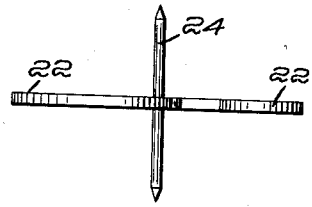



Fig. 4.

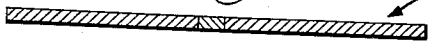



Fig. 5.

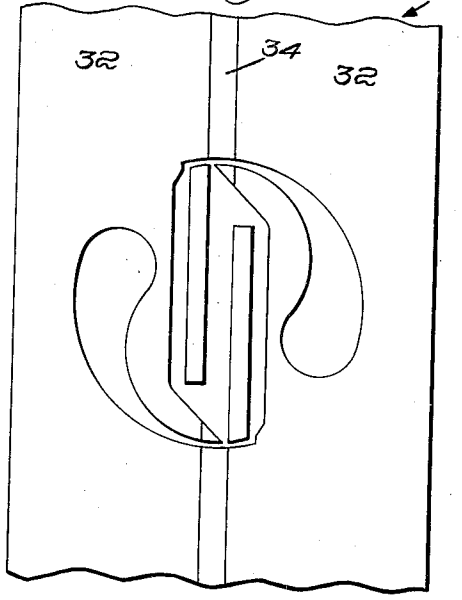



Fig. 6.

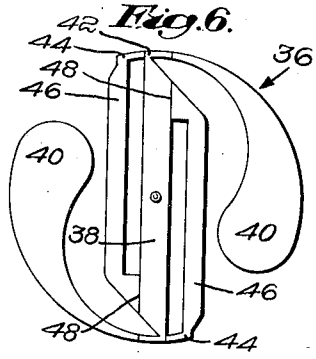
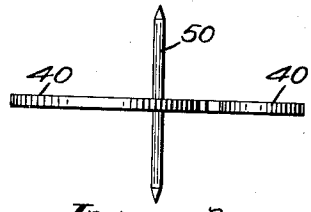



Fig. 7.




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# UNITED STATES PATENT OFFICE

2,232,742

## METHOD OF MAKING COMPENSATING BALANCE WHEELS AND THE LIKE

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Application January 26, 1939, Serial No 252,893

3 Claims. (Cl. 164—18)

This invention relates to temperature compensating devices, more particularly compensating balance wheels for clocks and the like, and to the method of producing the same, and the primary object of the invention resides in the more economical and rapid production of superior devices of this nature in mass quantities. The article produced by this method is claimed in my divisional application Ser. No. 359,737, filed October 4, 1940.

It is well known that the rate of movement of balance wheels used in clocks and watches varies with temperature conditions, due to the action of heat and cold more particularly on the hair spring employed. Lowering of the temperature causes the spring to become stiffer which in turn increases the rate of oscillation of the balance wheel, and raising of the temperature in like manner decreases the rate of the balance wheel. I am aware that compensating balance wheels have been known which automatically compensate for such changes in temperature by increasing the moment of inertia of the wheel upon lowering of the temperature, and vice versa, whereby causing the wheel to run substantially at a uniform rate at all prevailing temperatures. All of such wheels have however been expensive to produce and some have comprised a plurality of relatively loose and fragile parts. A further object of my invention resides in the production of an improved and more substantial compensating balance wheel formed in one piece and embodying spokes of dissimilar metals having substantially different coefficients of expansion.

These and other features of the invention will be best understood and appreciated from the following description of preferred embodiments thereof selected for purposes of illustration and shown in the accompanying drawing in which,

Fig. 1 is a fragmentary view of a compound metallic strip from which one of my improved balance wheels has been blanked,

Fig. 2 is a front elevation of the blanked wheel,

Fig. 3 is an edge elevation of the wheel,

Fig. 4 is a transverse sectional view through the strip,

Fig. 5 is a fragmentary view of another compound metallic strip from which has been blanked a modified form of balance wheel,

Fig. 6 is a front elevation of the blanked wheel,

Fig. 7 is an edge elevation of the wheel.

Referring more specifically to the drawing wherein I have illustrated certain applications of my invention, 10 indicates a compound metallic strip comprising two relatively wide portions 12 of one metal and a relatively narrow portion 14 of another metal therebetween, the metals being dissimilar and having different co-efficients of expansion. The strip is formed by rolling the combined metals to the required thickness and wherein the portions 12 and 14 are united at their edges into an integral unit.

In Fig. 2 is illustrated a balance wheel 15 which has been blanked from the strip 10. The wheel comprises a hub 16, two pairs of spokes 18 and 20 and two peripheral portions 22 each supported by a pair of spokes 18 and 20. The two portions 22 are disposed at opposite sides of the hub and each comprises a relatively heavy lobe supported on and overhung from the two spokes 18 and 20.

The peripheral portions 22 of the wheel and the spokes 20 are formed from the relatively wide strip portions 12, and the spokes 18 are formed from the narrow strip 14. The spokes 20 are integral with the hub at their inner ends and are integral with intermediate portions of the lobes 22 at their outer ends. The spokes 18 are integral with the hub at their inner ends and have their outer ends integrally connected with the smaller ends of the members 22 at points remote from the spokes 20.

Since lowering of the temperature stiffens the hair spring cooperating with the balance wheel and thereby shortens its period of oscillation whereby speeding up the rate of the wheel, it is required that such lowering of temperature shall provide compensation by increasing the moment of inertia of the wheel. Such increase is automatically cared for by forming the spokes 18 of a metal having a greater co-efficient of expansion than that of the spokes 20, whereby the lobes 22 are swung outwardly by the relatively greater contraction of the spokes 18 upon lowering of the temperature, a rise in temperature acting conversely to swing the lobes inwardly. The two metals should be such as to provide a relatively large difference in their co-efficients of expansion and I have found that "Invar" steel and brass provide two such metals. In the strip shown in Fig. 1 the two wide strip portions 12 may be of "Invar" steel and the relatively narrow strip 14 may be of brass. The greater expansion or contraction of the brass serves in the spokes 18 to rock the lobes 22 inwardly or outwardly respectively on the spokes 20. The wheel is supported and operated on a staff 24 disposed centrally through the hub 16.

The compound strip 30 shown in Fig. 5 is like the strip 10 shown in Fig. 1 except that the relatively wide portions 32 are of a metal, such as

brass, having a substantially greater coefficient of expansion than the metal, such as "Invar" steel, in the narrow portion **34**. The balance wheel **36** blanked from this strip comprises a bar or spoke portion **38** connected at its ends to the peripheral portions or lobes **40** at points **42**, this bar **38** being blanked from the strip portion **34**. The small ends of the lobes **40** overhang the spoke connections **42** at **44** and each has connected thereto one end of a spoke portion **46** extending parallel with the spoke portion **38** and having its other end integrally connected thereto at **48**. The wheel is supported and operated on a staff **50** disposed centrally through the bar **38**.

It will be apparent that lowering of the temperature, which causing speeding up of the rate of the balance wheel, serves through the relatively greater contraction of spoke portions **46** to throw the elements **40** outwardly, and raising of the temperature conversely serves through expansion of the portions **46** to throw the elements **40** inwardly, the elements **40** pivoting about the points **42**. This construction is somewhat more sensitive than the construction illustrated in Fig. 2 since the spoke portions **46** are relatively longer (as compared with the companion spoke portions **38** and **20**) than are the spoke portions **18**. An important feature of the invention relates to the overhanging portion **22** or **40** of a compensating wheel or like compensating device and the cooperating relation of the spoke elements whereby a relatively small temperature change effects a considerable movement of the overhanging body due to the leverage obtained.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. A method of making compensating balance wheels or the like which consists in providing a compound metallic strip having incorporated therein and extending longitudinally thereof a relatively narrow portion of metal having a co-efficient of expansion different than that of the main body of the strip, and so blanking the balance wheels or the like from the strip that peripheral and spoke portions thereof are formed from the main body of the strip and certain other spoke portions are formed from the said relatively narrow portion of metal.

2. A method of making compensating balance wheels or the like which consists in providing a flat metallic strip embodying two relatively wide outer portions of one metal and a relatively narrow intermediate portion of another metal therebetween of different co-efficients of expansion all in the transverse plane of the strip, and so blanking said wheels or the like from the strip that spoke-supported peripheral portions and certain other spoke portions thereof are respectively formed from said outer and intermediate portions of the strip.

3. A method of making a poly-metallic temperature compensating device having a hub portion integrally connected to one end of a body portion by two spoke like elements and beyond which the body portion has a considerable overhang, which consists in providing a compound metallic strip wider than its thickness embodying two portions of dissimilar metals having different co-efficients of expansion extending longitudinally of the strip and adjacent to each other transversely of the strip, and so blanking the device from the strip that the body portion and one spoke are formed from one portion of the strip and the other spoke is formed from the other portion of the strip.

GRAYDON SMITH.