

(No Model.)

H. BILGRAM.  
BALANCE WHEEL FOR TIME PIECES.

No. 455,787.

Patented July 14, 1891.

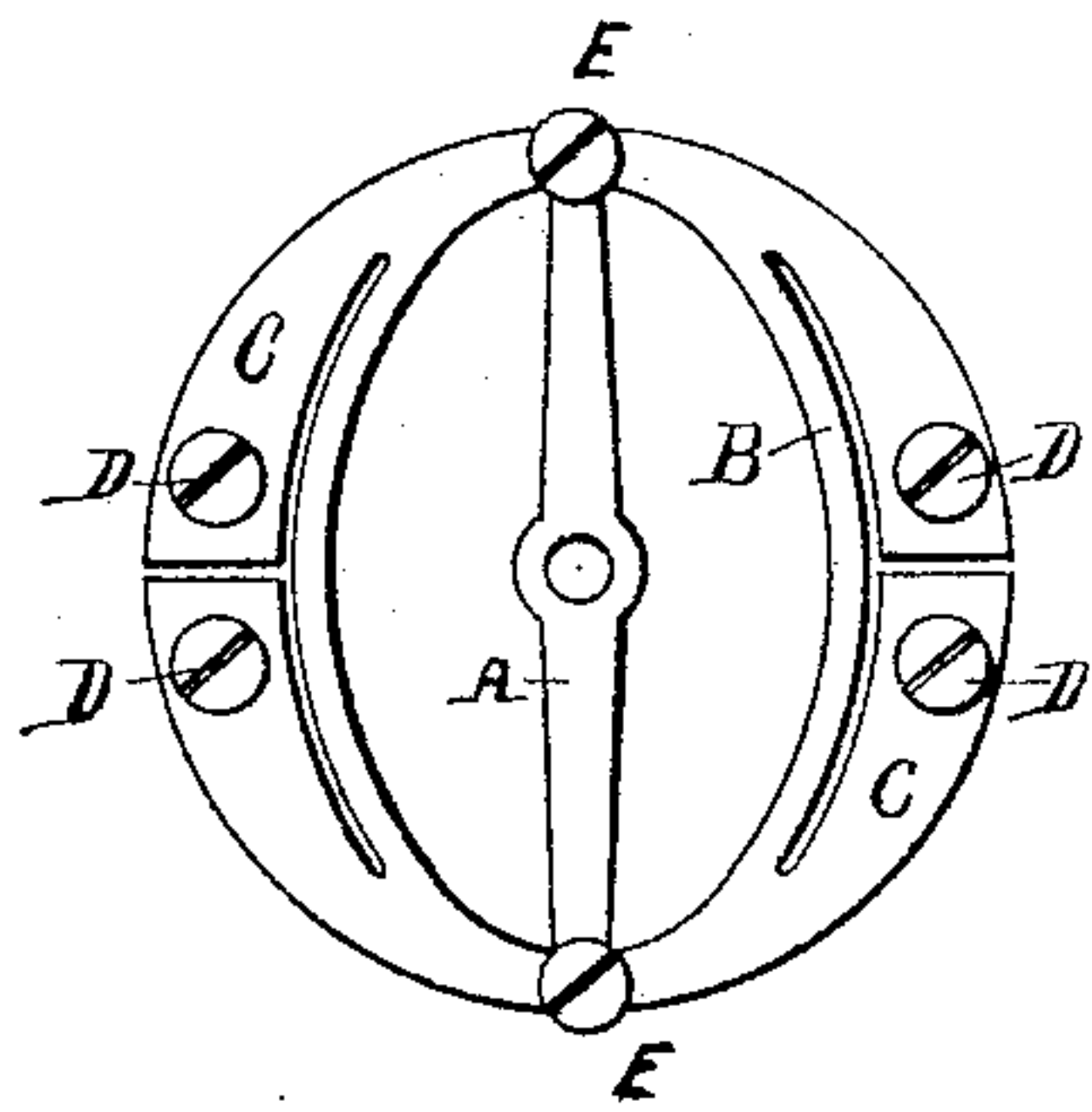


FIG. 2.

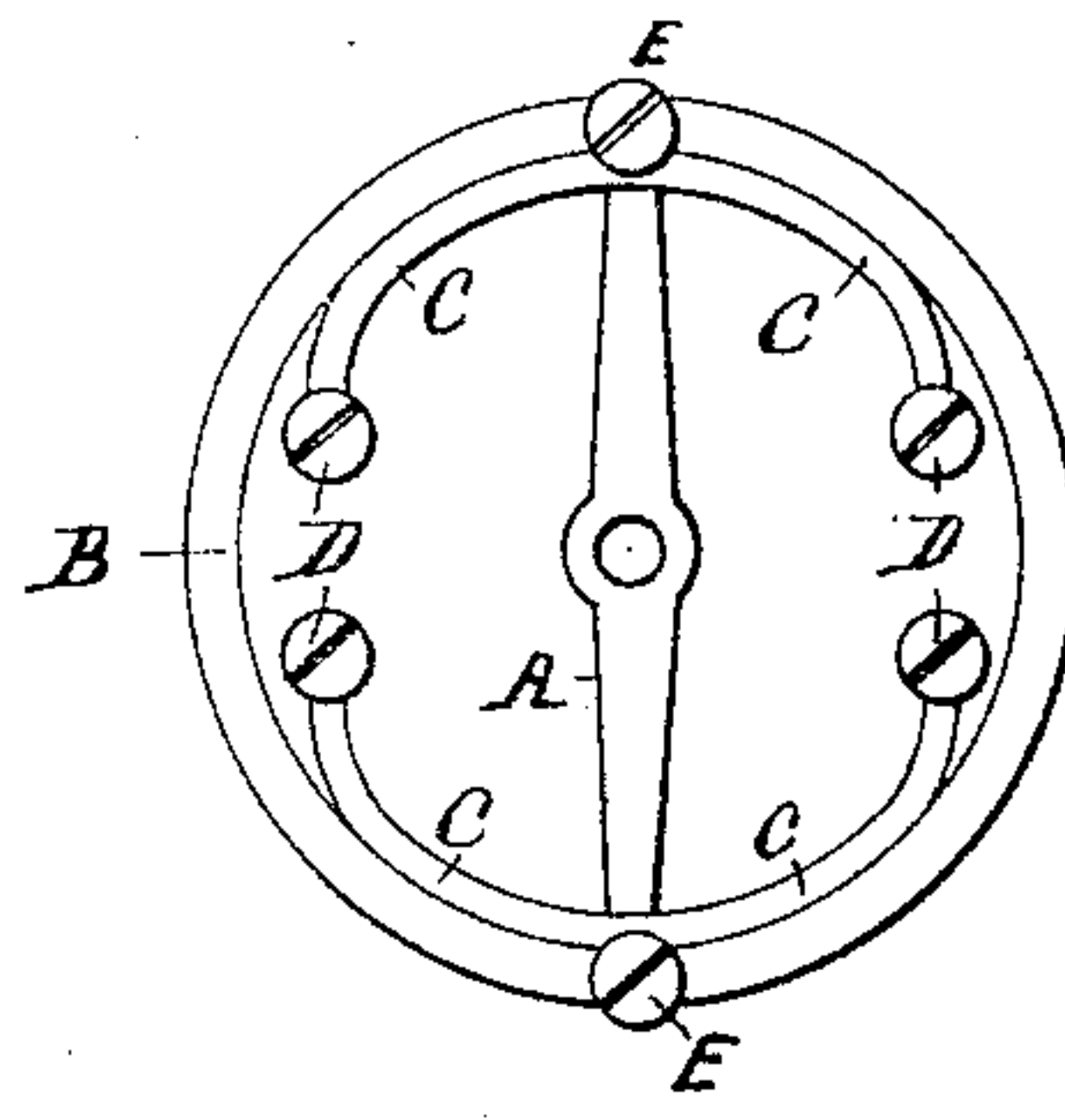


FIG. 5.

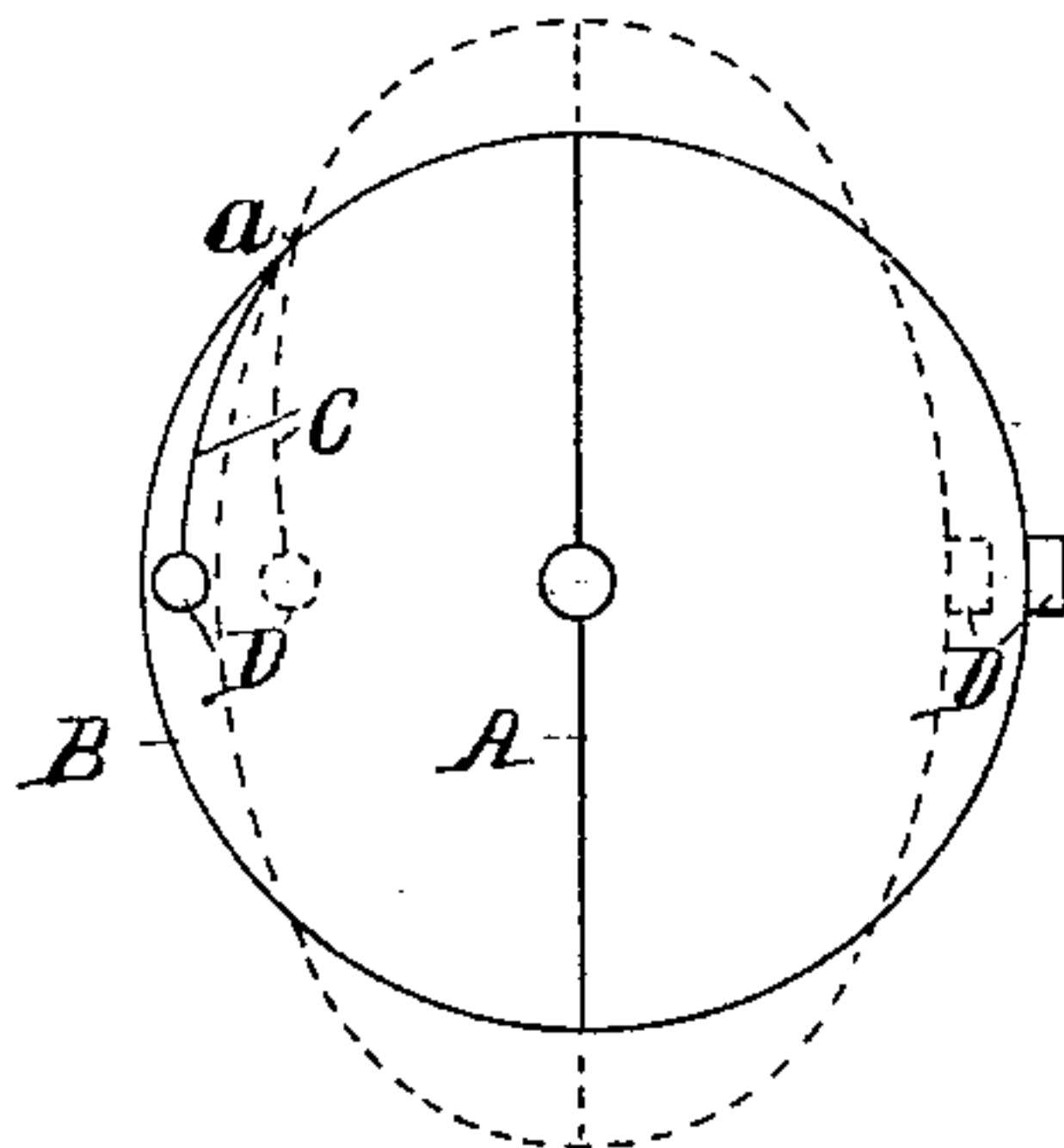


FIG. 1.

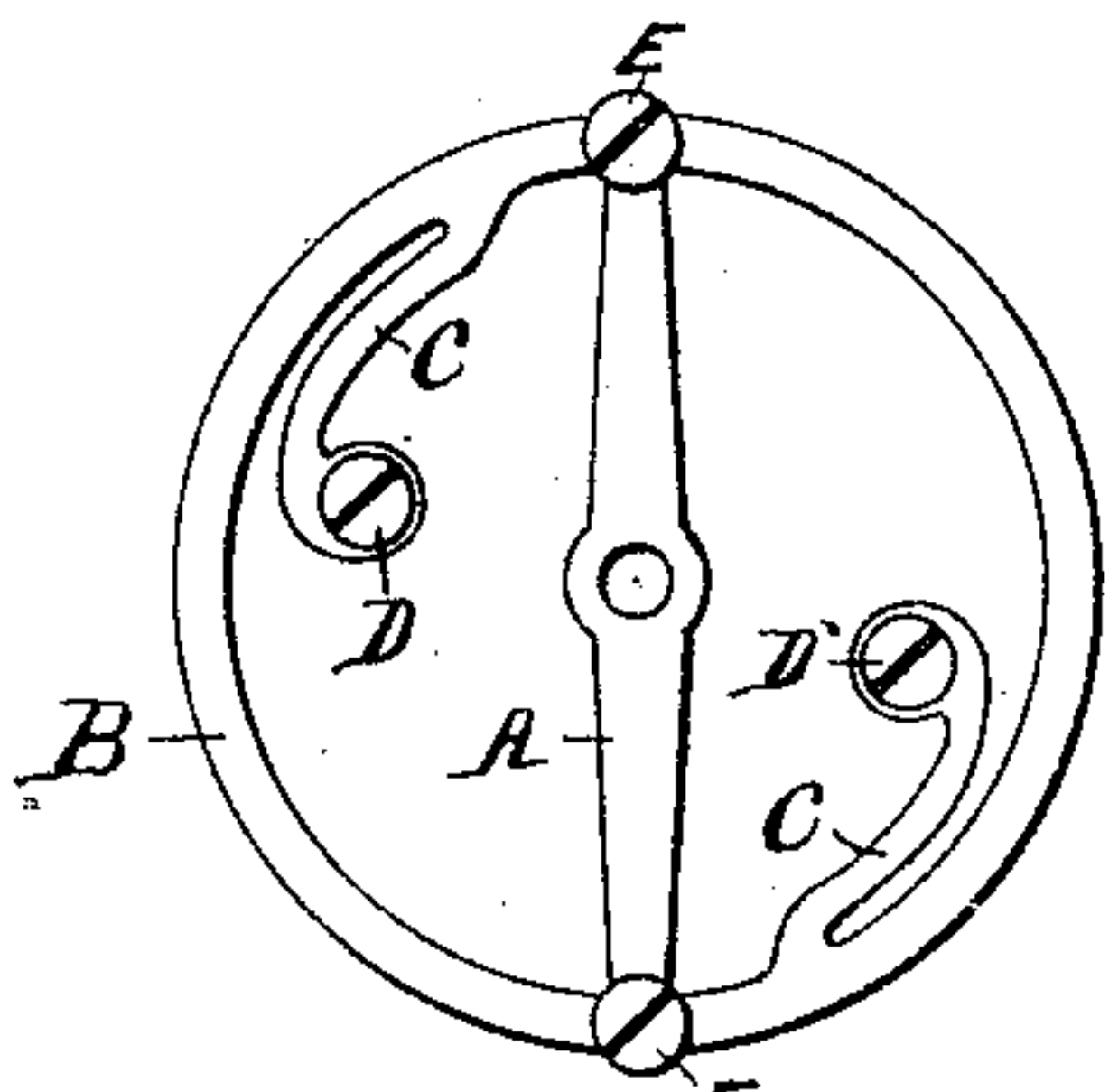


FIG. 3.

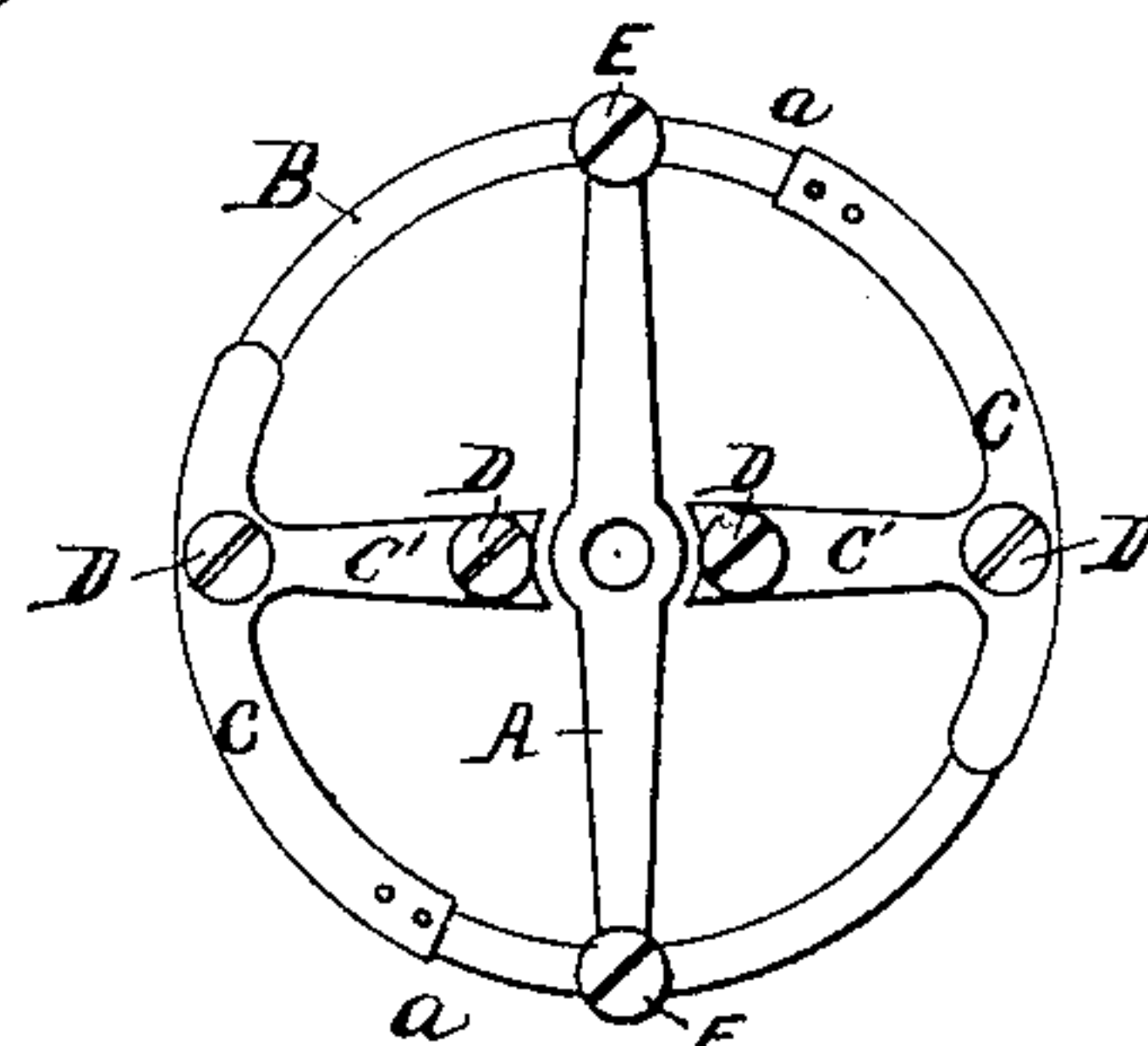


FIG. 4.

WITNESSES:

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# UNITED STATES PATENT OFFICE.

HUGO BILGRAM, OF PHILADELPHIA, PENNSYLVANIA.

## BALANCE-WHEEL FOR TIME-PIECES.

SPECIFICATION forming part of Letters Patent No. 455,787, dated July 14, 1891.

Application filed May 24, 1890. Serial No. 353,009. (No model.)

*To all whom it may concern:*

Be it known that I, HUGO BILGRAM, a citizen of the United States of America, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Balance-Wheels for Clocks and Watches, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to the construction of a compensating balance-wheel for clocks and watches; and it consists in a construction thereof hereinafter set forth, at once simple, cheap, and effective.

Referring to the accompanying drawings, Figure 1 is a diagrammatic representation exemplifying the principle of my invention. Figs. 2, 3, 4, and 5 are forms of practical construction of a balance-wheel according to this principle.

In all of these the spokes A of the wheel are of zinc or brass, or other material more expansible under increase of temperature than the material composing the rim, and the rim B is composed of steel or other material less expansible under increase of temperature than the material composing the spokes.

Referring to Fig. 1, the solid and dotted lines, respectively, indicate the relative positions of the spokes and rim under lower and higher temperatures in highly exaggerated proportions. It will be observed that upon expansion the sides of the rim between the spokes are drawn toward the center, and that by a weight, as D, on the rim the effect of this movement in reducing the momentum of gyration of the wheel is enhanced, and it will also be observed that the greatest angular movement is at or near the point marked *a*, and that an arm, as C, connected to the rim at this point will have a movement at its end much greater than the rim at the corresponding point, and that a weight, as D, placed at the end of this arm will have a greater effect in equalizing the momentum of gyration of the wheel under varying temperatures than if on the rim, and if of sufficient mass will reduce this momentum upon increase of temperature.

Like letters represent like parts in Figs. 2, 3, 4, and 5, which represent some of the forms in which the principle may be applied. In

Fig. 2 the arms are placed without the rim. In Fig. 3 the arms are placed within the rim. In Fig. 4 the arms are placed upon the rim secured by rivets at *a*, and are furnished with a bar C', by which part of the weight of the arm is brought near the center. In Fig. 5 the arms are connected at the junction of the spokes and the rim and are of a curve similar to that of the rim, so that under expansion their points of contact change and the inward movement of the weights is enhanced in a progressively-increasing ratio. The rim may be circular, or for greater effect may be elliptical, as shown in Fig. 2, the angular movement, as at *a*, being greater in proportion to the eccentricity of the ellipse. E E are weights, which may be attached at the ends of the spokes to counteract the effect of the weights D under changes of temperature where it may be found necessary.

I claim as my invention—

1. A balance-wheel for clocks and watches, consisting of spokes of a material more expansible and a rim of a material less expansible under increase of temperature, said rim being in length less than the circumference of a circle of which the distance between the ends of the spokes is the diameter.

2. A balance-wheel for clocks and watches, consisting of spokes of a material more expansible and a rim of a material less expansible under increase of temperature, and having weights connected to the rim between the spokes by arms adapted upon expansion to give to the weights a movement greater than that of the corresponding part of the rim.

3. A balance-wheel for clocks and watches, consisting of spokes of a material more expansible and a rim of a material less expansible under increase of temperature, and having weights connected to the rim between the spokes by arms adapted upon expansion to give to the weights a movement greater than that of the corresponding part of the rim in a progressively-increasing ratio.

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

HUGO BILGRAM.

Witnesses:

G. MORGAN ELDRIDGE,  
GEORGE E. HOUSE.