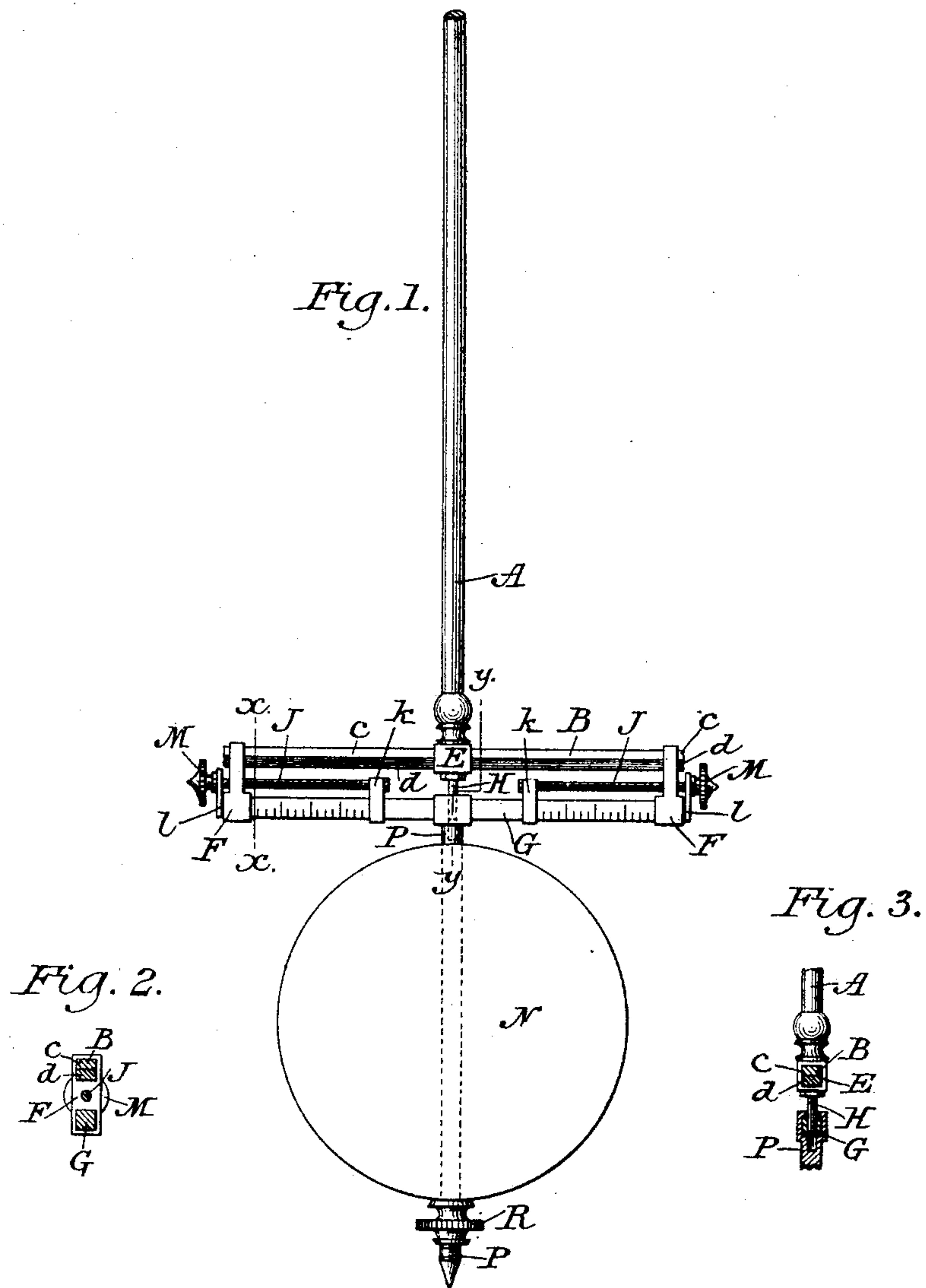


(No Model.)

E. R. MALMBORG.
COMPENSATION PENDULUM.

No. 472,624.

Patented Apr. 12, 1892.



WITNESSES:

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ERNST R. MALMBORG, OF ST. LOUIS, MISSOURI, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NEW YORK ELECTRICAL DEVICE COMPANY, OF VIRGINIA.

COMPENSATION-PENDULUM.

SPECIFICATION forming part of Letters Patent No. 472,624, dated April 12, 1892.

Application filed December 11, 1889. Renewed October 14, 1891. Serial No. 408,662. (No model.)

To all whom it may concern:

Be it known that I, ERNST R. MALMBORG, of the city of St. Louis, in the State of Missouri, have invented a new and useful Improvement in Pendulums; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

This invention relates to a compensating or self-adjusting pendulum which shall remain constant in its length and consequently be isochronal in its movement irrespective of changes of temperature.

It consists in the novel means hereinafter described and claimed, whereby the normal length of the pendulum is automatically maintained without change, notwithstanding the variations in temperature to which it is exposed.

In the accompanying drawings, Figure 1 is a front view in elevation of my improved compensating pendulum; Fig. 2, a cross-section in line *x x*, and Fig. 3 an irregular cross-section in line *y y* of Fig. 1.

A represents the pendulum-rod. B is a compound cross-bar secured to its lower end, and which is composed of two parallel strips *c d* of equal size, the one of brass, zinc, or silver and the other of steel or platinum, or of such other two metals or metallic alloys as expand and contract unequally under changes of temperature. The two strips are so placed as that the strip *d*, having the greatest range of expansion and contraction, shall lie under the strip *c*, whose range is more limited, and they are united together by any suitable means—as, for example, by soldering the one to the other—so as to form in effect a single compound bar. This compensating bar B is preferably made rectangular in cross-section and is passed through and secured at the middle of its length within a rectangular socket E, fixed to the lower end of the rod A.

F F are hangers mounted to slide freely upon each end of the compound compensating bar B. G is a metallic weight-rod of the same length as said bar, suspended from these hangers parallel therewith and a short dis-

tance below it. This parallel weight-rod G is mounted to play freely through suitable transverse apertures in the lower ends of the two hangers F F; but its longitudinal movement is prevented by means of a pin H, projecting from the end of the pendulum-rod A in line with its axis into an aperture pierced through the middle of the length of said rod G. The middle of the rod is thereby left free to play vertically upon the guide-pin H to and from the compensating bar B, and the hangers are left free to be moved longitudinally upon the bar and rod. These hangers may be moved and adjusted upon the compensating bar B by any suitable means—as, for instance, by means of screws J J, carried parallel with the bar B and rod G and intermediate the two through threaded apertures in the hanger. The inner end of each screw is made to engage a lug or offset *k* upon the weight-rod G, so as to be free to revolve independently therein and yet be attached thereto, and its outer end projects through and engages in like manner a lug or offset *l*, fixed to the outer end of the rod, in which it is also free to revolve loosely. The outer end of each screw is furnished with a milled head M, by means whereof it may be easily revolved, and the revolution of the screw will operate to move the hanger through which it passes to or from the inner lug *k* and the middle of the rod. By this means the position of the hangers with reference to the pendulum-rod A, and consequently the proportion of the length of the compound bar B to be embraced between the pendulum-rod and the hanger, is very readily adjusted. The pendulum is completed in customary form by means of a weight or bob N. This bob is secured to the middle of the weight-rod G centrally in line with the axis of the pendulum-rod A by means of a rod P, fixed to said rod G at a right angle thereto and upon which the weight is free to slide. It is adjusted in the customary manner to and from the weight-rod by a nut R, screwing upon the lower end of said weight-rod P.

In the operation of this device an increase of temperature sufficient to elongate the pendulum-rod A will operate to cause the lower member *d* of the compound compensating bar B

to expand and lengthen, and thereby bend the bar, so as to lift the two hangers F F and with them the rod G, carrying the weight or bob N of the pendulum, while if the temperature be reduced the opposite effect will be produced and the contraction of the member *d* of the compensating bar will lower the hangers F F and rod G, and thereby lower the pendulum-weight. By a proper adjustment of the position of the hangers F F upon the compensating bar B the weight N will be elevated or depressed in such exact proportion to the increase or decrease in the length of the pendulum, owing to variations of temperature, as practically to maintain a constant uniform length in the entire pendulum.

I claim as my invention—

The combination, in a compensating device for pendulums, of the single compound com-

pensating bar B, the hangers F F, sliding loosely upon the two ends of the bar, the weight-rod G, suspended loosely in said hangers, the single central guide-pin P, projecting from the compensating bar into a central socket in the weight-rod, and the adjusting-screws J J, working through threaded apertures in the hangers and engaging at their inner ends lugs *k k*, secured to the weight-rod, substantially in the manner and for the purpose herein set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ERNST R. MALMBORG.

Witnesses:

W. N. BARRON,
BEN S. WASH.