(No Model.)

A. L. PARCELLE.

PENDULUM FOR CLOCKS.

No. 383,539. Patented May 29, 1888.

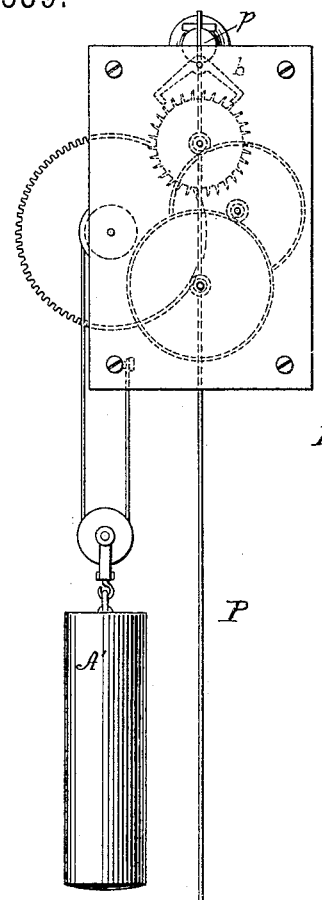

Fig. 1.

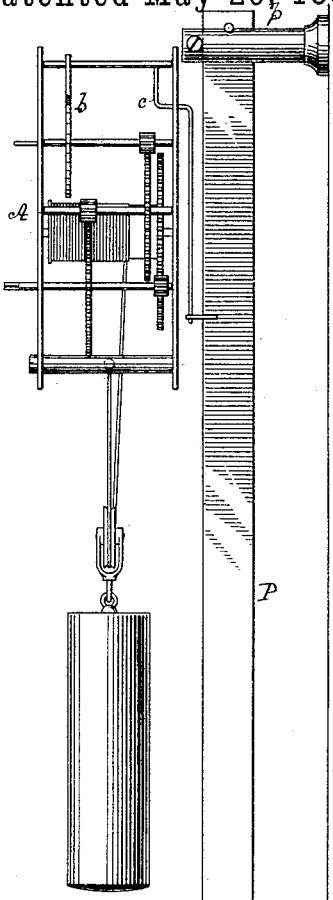

Fig. 2.

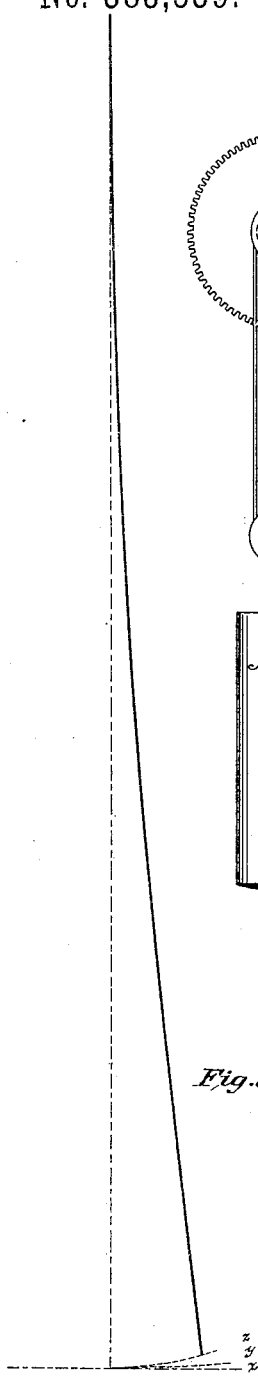

Fig. 3.

Witnesses.
Geo. W. Breck.
Carrie E. Ashley

Inventor.
Albert L. Parcelle,
By his Attorneys.
Baldwin, Hopkins & Peyton.

UNITED STATES PATENT OFFICE.

ALBERT L. PARCELLE, OF NEW YORK, N. Y.

PENDULUM FOR CLOCKS.

SPECIFICATION forming part of Letters Patent No. 383,539, dated May 29, 1888.

Application filed April 7, 1887. Serial No. 234,048. (No model.)

To all whom it may concern:

Be it known that I, ALBERT L. PARCELLE, of Boston, in the county of Suffolk and State of Massachusetts, at present residing in New York, in the State of New York, have invented a new and useful Improvement in Clocks, of which the following is a specification.

The object of my invention is to improve the regularity and action of pendulum-clocks.

The invention consists, generally stated, in the employment of a resilient pendulum clamped at one end. Heretofore two kinds of pendulums have been used—viz., a straight pivoted pendulum and a straight pendulum suspended by a short thin suspension spring. My pendulum is distinguished from these by the fact that it is formed of a resilient body held firmly by its upper end, so that it vibrates under conditions other than those of the ordinary pendulum, as appears from the following description.

The invention also consists in a pendulum formed of a continuous strip of resilient material, so that in vibrating it not only bends at or near its point of suspension, but also in its length or body, and this fact clearly distinguishes it from the ordinary pendulums above mentioned.

The purpose of my invention is to produce a pendulum which will describe a perfect or approximately perfect cycloidal arc, and will therefore vibrate long and short arcs in the same time, and will by reason of its resiliency tend to continue in vibration much longer than the pendulums now in use.

An incidental feature of my invention of considerable importance is its automatic compensation described below.

In the accompanying drawings, Figure 1 is a front elevation illustrating without elaboration or detail a weight-driven clock-train equipped with my improved resilient pendulum. Fig. 2 is a side elevation of the same, and Fig. 3 is a diagram view illustrating the path described by the end of a pendulum resilient throughout its length.

A clock-pendulum which describes a segment of a circle in swinging is influenced entirely by gravity, its velocity being determined by the distance it falls in reaching its lowest point or perpendicular position. It is well known that the long and short arcs of such a pendulum are not made in the same time, and hence it is not isochronous, except under certain conditions, which are very difficult to maintain. Ordinarily the pendulum of a clock receives the impulses which maintain it in vibration from a weight or spring acting through a train of wheels. The wheels and pinions of the train, however carefully they may be made, are not perfect either in material or workmanship. The oil used to lubricate them becomes stiff, particles of dust accumulate on the wheels and their bearings, and some of the parts are worn more than others. The impulses imparted to the pendulum will therefore vary more or less according to the condition of the train. If a weight is used as a driver, as the weight runs down the weight of the cord is added to the weight; and if a spring be used as a driver the power applied is still more variable, because as the spring uncoils the force of the impulses imparted by it to the pendulum decreases. These facts are mentioned to illustrate the difficulty of imparting to the pendulum impulses of uniform power. Consequently the arc of vibration is not uniform and the pendulum is not isochronous. A pendulum which describes a cycloidal arc is, however, isochronous, whatever may be the variation, within certain limits, of the length or amplitude of its vibration.

In the drawings, A represents an ordinary clock-train, driven by a weight, A′.

b is an ordinary clock-scapement. The pendulum P is adjustably clamped at its upper end in a split post, *p*. The lever *c* is connected with the spindle of the pallet, and is carried down and embraces the pendulum, as usual.

My improved pendulum here illustrated may be formed of any suitable resilient material. It may be made, for instance, of steel, whalebone, wood, glass, bone, &c., or any other resilient material, and preferably of such material as is not influenced or subject to change on account of variations of temperature and moisture. It is capable of bending from end to end, and it is preferably in the shape of a flat thin bar of the general character shown in the drawings. A pendulum of this character is isochronous for all amplitudes of vi-

bration required in a clock. To operate at the same rate or number of beats as a gravity-pendulum, it may be longer or shorter than such a pendulum. It is not governed by the same laws that control an ordinary pendulum, but is dependent upon two conditions—namely, its length and thickness. Gravity does not primarily control its action, as its own inherent resilience serves to return it to the center of vibration or perpendicular position.

My improved pendulum is preferably equipped with a bob, which may be a hollow cylindrical cup adapted for the reception of sand or shot or any other suitable weighting material. The bob may be adjusted for regulation in the ordinary way by a thumb-nut on the screw-rod extension of the pendulum. A bob may or may not be used. Its effect would be to add steadiness; but it may be dispensed with or a very light one used, according to the material used for the pendulum. Where a bob is employed it will very slightly, according to its weight, modify the arc.

The pendulum may be compensated by any of the ordinary methods, but has the advantage of being partially self-compensating. A change of temperature which would elongate it would also tend to increase its thickness. This automatic compensation is sufficient for ordinary clocks.

The diagram view, Fig. 3, illustrates the character of the arc described by such a pendulum as that shown. *x* represents a base or tangential line, *y* the arc described by an ordinary pendulum, and *z* the arc described by my improved pendulum.

My invention is distinguished from ordinary clock-pendulums having suspension-springs formed separately or by drawing down the end of a wire pendulum. Such suspension springs serve merely as hinges upon which the pendulum—which is a gravity-pendulum—vibrates. In my improved device the pendulum proper bends in its length in vibrating, and when I use the term "bends or bending in its length" I mean the rod, strip, or bar forming the pendulum proper bends in vibrating to such extent as to give it the character of an elastic vibrator, as herein set forth, as distinguished from the bending of a mere suspension-spring, for by forming the pendulum of resilient material and causing it to bend in vibrating, it is governed, at least in part, by the laws governing elastic vibrators, and is to that extent different from ordinary gravity spring-suspended pendulums. Preferably the spring-pendulum is made to bend throughout its entire length, as more perfect results are believed to be attained thereby.

In an application for patent heretofore filed by me, and patented April 12, 1887, No. 360,903, I have shown a pendulum of the character herein described actuated electrically, and have claimed it. I therefore disclaim herein any subject-matter claimed in said patent.

I claim—

1. The combination, substantially as set forth, of a driven train, a pendulum formed of a bar or strip of resilient material rigidly held at its upper end and bending in its length as it vibrates, and a scapement interposed between the pendulum and the clock-train.

2. A pendulum substantially such as herein described, formed of a flat elongated strip of resilient material adapted to be rigidly held at one end in its support and capable of bending in its length.

3. A pendulum substantially such as herein illustrated, consisting of a bar or strip of resilient material of uniform or substantially uniform cross-section rigidly held at its upper end in its support and bending in its length as it vibrates.

4. A pendulum substantially such as herein described, consisting of a bar or strip of resilient material rigidly held in its support at its upper end, having a suitable bob, and capable of bending in its length as it vibrates.

5. The combination, substantially as set forth, of a driven train, a pendulum formed of a bar or strip of resilient material capable of bending throughout its entire length as it vibrates, and a scapement interposed between the pendulum and train.

ALBERT L. PARCELLE.

Witnesses:
T. F. HASCALL,
W. W. WHEELOCK.