(No Model.) 3 Sheets—Sheet 1.

A. L. PARCELLE.

ELECTRIC PENDULUM CLOCK.

No. 384,271. Patented June 12, 1888.

Fig. 1,

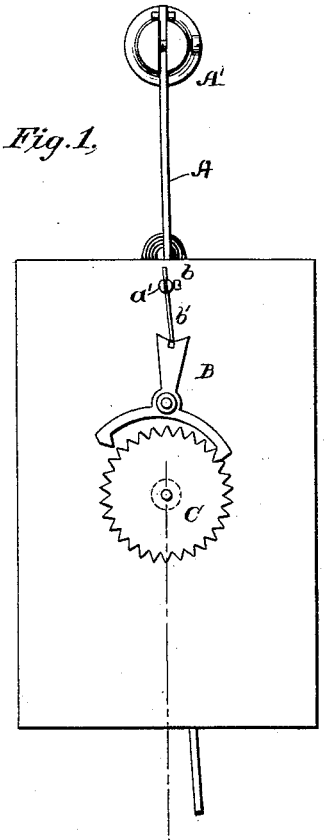


Fig. 2,

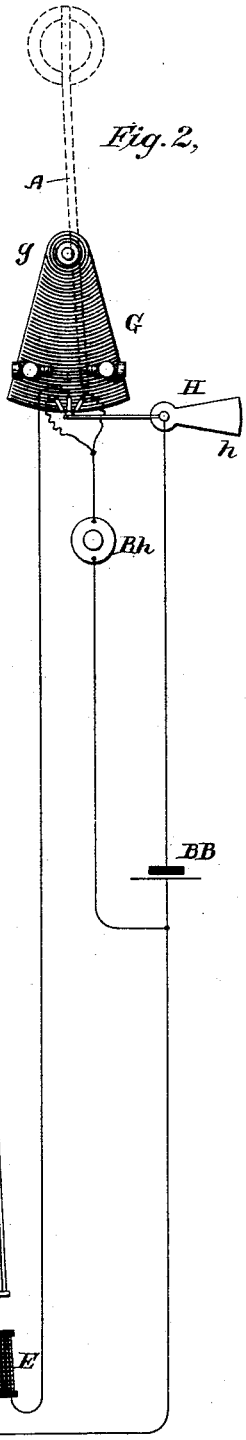
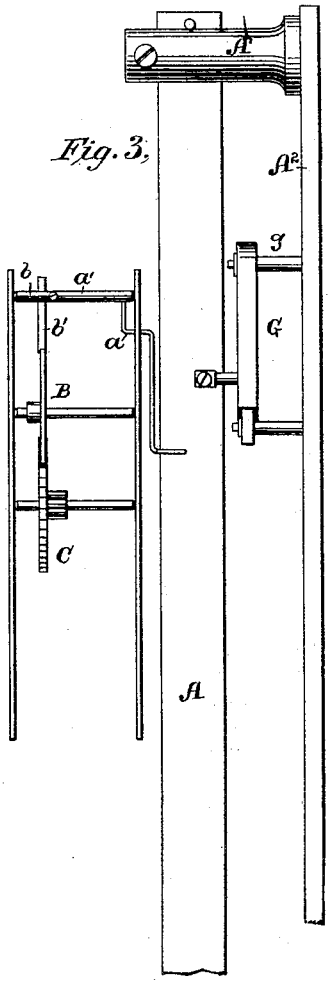


Fig. 3,



Witnesses.

Geo. W. Breck,

C. M. Newman,

Inventor,

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 4.

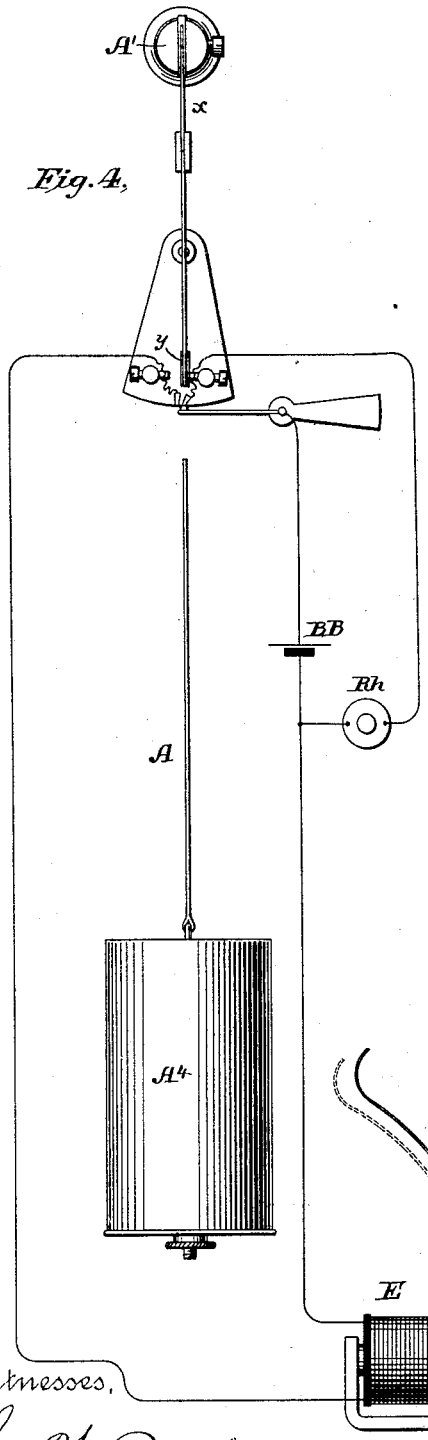
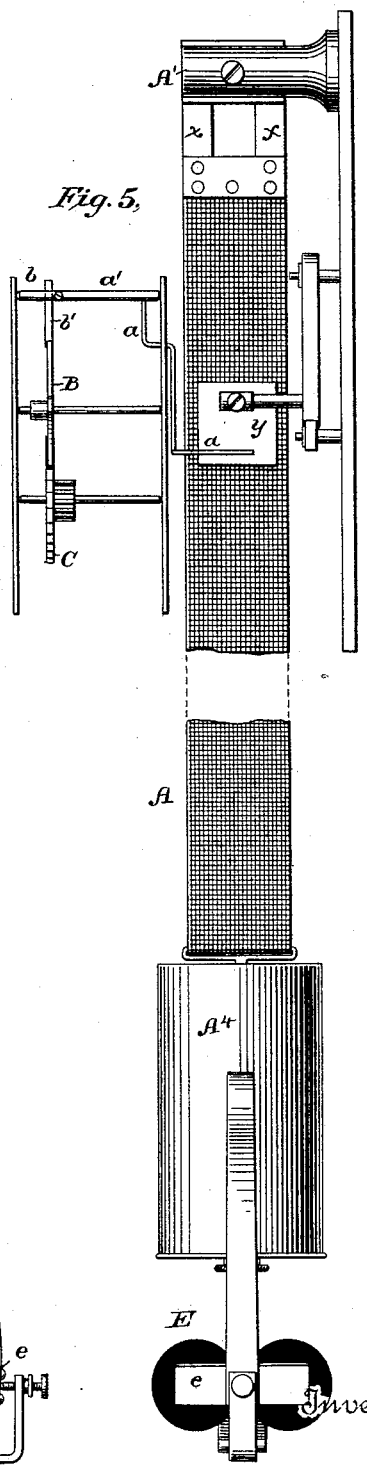


Fig. 5.



Witnesses,
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Fig. 6.

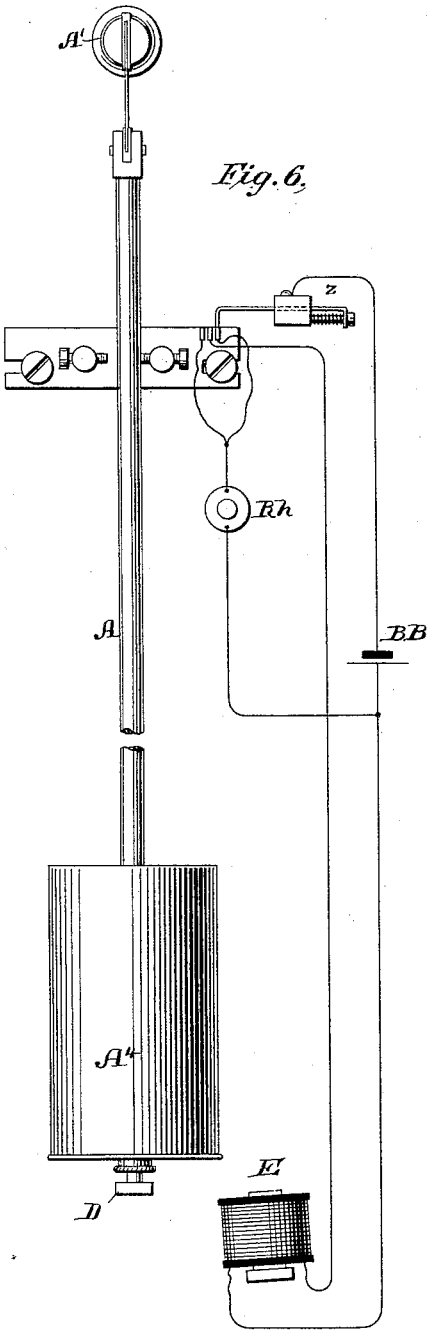


Fig. 7.

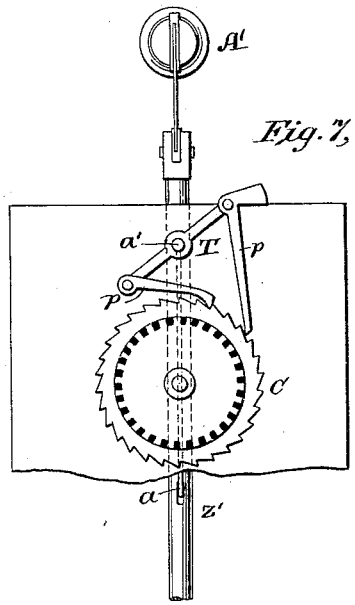
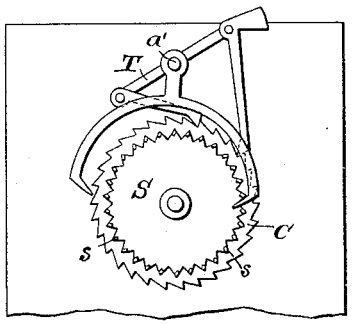


Fig. 8.



Witnesses,

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UNITED STATES PATENT OFFICE.

ALBERT L. PARCELLE, OF NEW YORK, N. Y., ASSIGNOR TO THE MANHATTAN CLOCK COMPANY, OF COLORADO.

ELECTRIC PENDULUM CLOCK.

SPECIFICATION forming part of Letters Patent No. 384,271, dated June 12, 1888.

Application filed March 23, 1887. Serial No. 232,141. (No model.)

To all whom it may concern:

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

In the accompanying drawings, Figure 1 is a partial front elevation with the pendulum partly broken away; Fig. 2, a diagram showing the circuits and switch devices and the actuating or motor magnet arranged in suitable relation to the bob in Fig. 1; Fig. 3, a side elevation illustrating the same general matter shown in Fig. 1; Fig. 4, a diagrammatic partial front elevation of another form of the apparatus; Fig. 5, a side view illustrating the same general matter; Fig. 6, a view showing a diagram of the circuits in connection with an ordinary rigid pendulum; Fig. 7, a detail view of a rotary switch which may be used instead of the oscillating or sliding switches illustrated in the other figures; and Fig. 8 is another view showing a manner of locking the clock-train.

In the various figures it has not been thought necessary to illustrate the clock-train. The train may be of the simplest character and be driven from a star or ratchet wheel actuated by the vibrating pendulum, as presently appears.

Referring to Figs. 1, 3, and 5, the pendulum A, in vibrating, rocks a vertical lever, *a*, one end of which is forked and embraces the pendulum and the other is connected with a rock-shaft, *a'*. This rock-shaft is split or slotted at *b* and carries an arm, *b'*, capable of being adjusted endwise in the slot and clamped by a set-screw, and the lower end of which engages a notched anchor-lever, B, having pallets that drive the wheel C and at the same time keep it locked. Before one pallet has left the teeth on one side the other pallet has entered between the teeth on the opposite side, and the hands cannot, therefore, be accidentally moved. The pallet-lever is rocked a fixed distance upon every vibration of the pendulum and arm *b'*, irrespective of the extent of vibration, the arm *b'* passing out of engagement with the notch in the pallet-lever when the pendulum has swung a given distance from the center of vibration. For instance, suppose that the pendulum in swinging two and one-half degrees carries one of the pallets to the bottom of a notch in the star-wheel, then the intermediate lever or arm, *b'*, passes out of the notch in the anchor-lever, and the further movement of the pendulum has no effect upon the train.

The pivoted oscillating switch G is a sector of a circle of which the pivot *g* is the center. Adjustable screws thereon embrace the pendulum, and by their adjustment the extent of movement of the switch may be regulated.

In Fig. 2 three contacts are shown arranged in the curved face of the switch. The middle one is connected through the coil of the motor-magnet E with one pole of the battery B B, while the outer ones are connected with the same pole of the battery through a resistance, R*h*. A pivoted brush, H, preferably weighted at one end, *h*, (or a spring may be used, if desired,) is connected with the opposite pole of the battery, and bears against the curved face of the switch.

In Fig. 1 the lever *b'* is just passing out of engagement with the anchor or pallet lever and the armature D is coming into the field of the magnet E, whose circuit has been completed by the movement of the pivoted switch G, as indicated in Fig. 2. The continued movement of the pendulum now under the attractive influence of the motor-magnet moves the switch to the right and transfers the brush H from the middle contact to the left-hand contact, thus breaking the circuit through the magnet E and short-circuiting the battery through the resistance R*h*. Preferably the contact of the brush H with the curved face of the switch is such that this short circuit is completed before the circuit through the motor-magnet is broken. The battery-circuit is therefore never open—a material advantage in working with some forms of battery. The pendulum having reached the end of its vibration and the motor-magnet being no longer energized, returns by its own gravity and resilience and completes its vibration on the opposite side of the center of vibration, indicated by the broken line in Fig. 1.

I have found in practice that it is unneces-

sary to have a magnet on each side of the center of vibration, although two magnets may be used, if desired.

In Figs. 1, 2, and 3 I have indicated the pendulum as made of a bar resilient throughout its length, its upper end being clamped in a split post, A′, mounted on a back board, A^2, which board may also carry the switch and driving devices and clock-train.

A^4 in all the figures indicates a bob, which may be a cylindrical cup to receive shot, sand, or other suitable material, whereby the weight of the pendulum may be regulated with the utmost nicety.

In Figs. 4 and 5 I have shown a flexible non-resilient pendulum suspended from a post, A′, and carrying a suitable bob or weighted cylinder. The pendulum may be made of any flexible material—such as webbing woven from various substances—or it may be of leather. At the top it is shown as suspended by two short suspension-springs, *x*, clamped in the post A′ and attached to a metal piece on the upper end of the pendulum. A plate, *y*, of metal or other suitable material, may be placed on each side of the flexible pendulum at the points where it comes in contact with the switch devices and driving mechanism. The bob A^4 should be of proper weight to keep the webbing straight and give it sufficient rigidity to perform its work. An ordinary bob—such as is used for a seconds-pendulum—is sufficient for this purpose. A pendulum of this character will not be materially affected by heat or cold, and no means of compensating for changes in temperature are necessary. If desired, the flexible material could be prepared so as not to be affected by dampness or changes of temperature. The form of switch shown in these two figures is the same as that above described, except that there are but two contacts in its curved face. With this arrangement the circuit will part of the time be broken and part of the time short-circuited.

I have shown another manner of driving the pendulum. The magnet E, instead of acting upon an armature on the end of the pendulum, has a pivoted armature, *e*, carrying a light spring-finger that is drawn against the bob at the proper time to give it a return impulse. For instance, suppose the pendulum is moving to the right, as seen in the figure. When it has reached the full extent of its swing, it will have moved the switch and completed the circuit of the magnet E through the brush and left-hand contact, and the spring will be drawn against the pendulum, thus giving it a return impulse. The circuit remains closed until the movement of the pendulum to the left operates the switch and opens the circuit, when the armature falls back. The two positions of the spring are indicated by the full and dotted lines. Uniform impulses of vibration are therefore imparted to the pendulum irrespective of the power of the battery. The spring is preferably long and light, and in practice I have found a piece of watch-spring sufficient for the purpose of giving impulses to a heavy seconds-pendulum. The magnet, its armature, and the spring are adjusted for, say, one-half the power of the battery, and as the battery is only used to pull the spring up against the pendulum the force of the impulses is uniform, depending, as it does, upon the resilience of the spring, and not upon the strength of battery. If preferred, a spring on each side of the pendulum could be used; but in practice I have found one sufficient. The circuit-connections are such in Figs. 2 and 4 that when the pendulum is at rest the circuit of the battery is closed through the resistance R*h* and one of the contacts of the switch. The bob A^4 may be raised and lowered by means of an adjusting-nut, as usual, and the stop against which the armature of the magnet E works may be covered with felt or cork to prevent noise.

In Fig. 6 I have shown an ordinary rigid pendulum provided with a bob and armature suspended from the post A′ by a short spring, as is usual. The pendulum works between the adjustable screws of a sliding switch, having three contacts connected in the manner shown in Fig. 2. The brush, however, is of a different character from that shown in Fig. 2. It is made to slide endwise in a suitable supporting-block, *z*, and is moved by a screw for the purpose of adjusting it accurately with reference to the switch-contacts. As in Fig. 1, the arrangement here is for the purpose of keeping the battery-circuit closed, and the figure merely illustrates such an arrangement of switch-contacts and battery with an ordinary pendulum.

Fig. 7 shows a rotary switch on the same arbor as the ratchet-wheel. It consists of a hub having alternate conducting-strips to be connected to the battery and intervening insulated spaces. A weighted brush, such as shown in Fig. 2, may bear upon the hub and make and break the circuit as the pendulum vibrates. In this arrangement a cross-arm, T, is secured on the end of the rock-shaft *a*′, and upon each end of the arm is carried a gravity-pawl, *p*, that engages in the teeth of the ratchet-wheel C. The movement of the pendulum on either side of the central line causes one or the other of the pawls to engage the ratchet-wheel and drive it forward one step. In this figure the driving-lever *a*, instead of being forked, enters an aperture, *z*′, in the pendulum, an ordinary bar-pendulum—such as that illustrated in Fig. 6—being shown.

In order that the gravity-pawls may only drive the ratchet-wheel a fixed distance at each swing of the pendulum, irrespective of its amplitude, the pawls may be thrown out of engagement with the teeth by stops or pins, against which they strike, as described in my prior patent of April 12, 1887, Fig. 3, or an intermediate arm or lever, *b*′, as in Fig. 1, may be employed.

In Fig. 8, in connection with driving grav-

ity-pawls, I have shown an arrangement for locking the train. Ordinarily when a ratchet-wheel is employed to drive a clock-train the hands may by accident be moved forward, and in case of a tower-clock some arrangement for preventing this is desirable, as the snow and wind are liable to move the hands. On the same arbor with the ratchet-wheel C is fixed another wheel, S, having a number of teeth or pins, *s*, projecting from its face. These teeth may, however, project from the side of the ratchet-wheel C, if desired. On the same arbor carrying the cross-arm T, on which the pawls are mounted, is placed a pallet-lever whose teeth are adapted to pass in and out between the teeth or pins *s* on the locking-wheel. In operation the pallets are gradually introduced and withdrawn from between the teeth of the wheel without interfering in the least with its rotation; but at no time is the train free to move except in response to the vibrations of the pendulum.

In Fig. 8, instead of having the arm T directly upon the spindle or rock-shaft *a'*, an intermediate driving-arm, *b'*, may be employed, as in Fig. 1; also, instead of employing a wheel, S, having pins or teeth projecting laterally from its sides, a star-wheel may be used, and the locking-pallets caused to pass in and out of the notches in the wheel. Other devices may doubtless be constructed to lock the train against accidental movement of the hands, and at the same time leave it entirely free to be driven by the driver or pendulum, without departing from my invention.

In my improved clock the pendulum is detached or disconnected from the train when the train has been driven a given distance irrespective of the battery or propelling-power, and the running of the train is therefore uniform.

By driving the pendulum with a power in excess of that requisite for operating the train and giving it an amplitude of vibration greater than required important results are obtained. For instance, should the battery fail from any cause, the pendulum will continue to move the train for some time before its amplitude becomes too small. The pendulum does all its work during the central part of its swing, when it is moving with the most vigor, and as it approaches the limit of its movement it is detached from the train and has no work to perform. Practically the pendulum is a free vibrator, what little work it has to do being done by it at the most advantageous point in its vibration.

The depending pivoted oscillating switch reduces the friction and resistance to a minimum. The contacts on its curved face, rubbing constantly against the brush H, are kept bright and clean, and as the curved face is at the bottom of the switch there is no tendency for dust or dirt to accumulate thereon. The movement of the switch at the point of suspension is very small, and since the arcs described by the switch and that part of the pendulum which actuates it, as well as that of the lever *a* and that part of the pendulum which drives it, all coincide or have the same direction, the entire mechanism runs smoothly and regularly.

I prefer to employ a weighted brush, because a uniform pressure on the switch is obtained thereby. With a spring the pressure would be liable to vary more or less.

Any suitable device for holding the pallet-lever steady after the intermediate arm or lever, *b'*, has passed out of engagement with it may be employed. For instance, an arrangement similar to that shown in my Patent No. 345,721, July 20, 1886, Fig. 4, could be availed of, should anything be required.

The various features of my invention have been illustrated in several figures of drawings showing different constructions, in order to illustrate in part how they may be adapted to varying structures. In practice I should of course combine them in one clock, as I think the best results may be obtained thereby.

I claim as my invention—

1. The combination, in an electric clock, of an electrically-driven pendulum, the driving-magnet which operates said pendulum, its battery and circuit, the moving switch actuated by the driven pendulum, the electrical contacts thereon, and circuit-connections whereby the driving magnet is intermittently energized to vibrate the pendulum without opening the battery-circuit.

2. The combination of the electrically-driven pendulum, the driving-magnet, its battery and circuit, switch devices actuated by the pendulum in its vibration, a brush and contacts on the switch, and a branch or short circuit through which the battery is short-circuited when the pendulum is at and near the limit of its swing, substantially as set forth.

3. The combination of the electrically-driven pendulum, the driving-magnet, its battery and circuit, switch devices actuated by the pendulum, three switch-contacts, the middle one being connected through the magnet with one pole of the battery and the other two connected with the same pole of the battery outside of the magnet, and the switch-brush connected with the opposite pole of the battery.

4. The combination of the electrically-driven pendulum, switch devices intermittently operated by the pendulum, the driving-magnet and its battery and circuit, and a weighted or gravity brush which bears on the switch.

5. The combination of the electrically-driven pendulum, electric-switch devices actuated thereby, electric contacts on the under or bottom face of the switch, and a brush which bears on the contacts.

6. The combination of the electrically-driven pendulum, the pendent pivoted switch, the contact or contacts on its curved bottom face, and a brush bearing thereon.

7. The combination of an electric-clock pendulum formed of a strip of flexible non-resilient material, electro-magnetic devices for driving it, and mechanism actuated thereby.

8. A clock-pendulum formed of a flat tape or web of flexible non-resilient material adapted to be suspended at one end and weighted at the other.

9. In an electric clock, the combination of a pendulum, switch devices actuated thereby, a driving-magnet which is intermittently energized by the action of the switch devices, and a spring intermittently drawn against the pendulum by the magnet to impart impulses of vibration thereto.

10. The combination, with a vibrating pendulum, of a spring intermittently drawn against the pendulum to impart impulses of vibration thereto.

11. The combination of a non-resilient pendulum, a spring intermittently drawn against the pendulum to impart impulses of vibration thereto, and electro-magnetic devices controlled by the pendulum for operating the spring.

12. The combination of a pendulum composed of non-resilient flexible material, a spring intermittently operated to impart impulses of vibration thereto, and electro-magnetic devices controlled by the pendulum for operating the spring.

13. The combination, in an electrical clock, of a pendulum, electro-magnetic devices for driving it, a clock-train driving-wheel, C, driving devices by which the wheel is driven by the pendulum, and independent locking devices which prevent the movement of the train-driving wheel except by the action of the pendulum.

14. The combination of the notched driving or pallet lever B, the rock-shaft a', actuated by the pendulum, the arm or lever b', and the set-screw or similar device for clamping the arm b' in or on the rock-shaft.

In testimony whereof I have hereunto subscribed my name.

ALBERT L. PARCELLE.

Witnesses:

T. F. HASCALL,

H. W. VANDER POEL.