

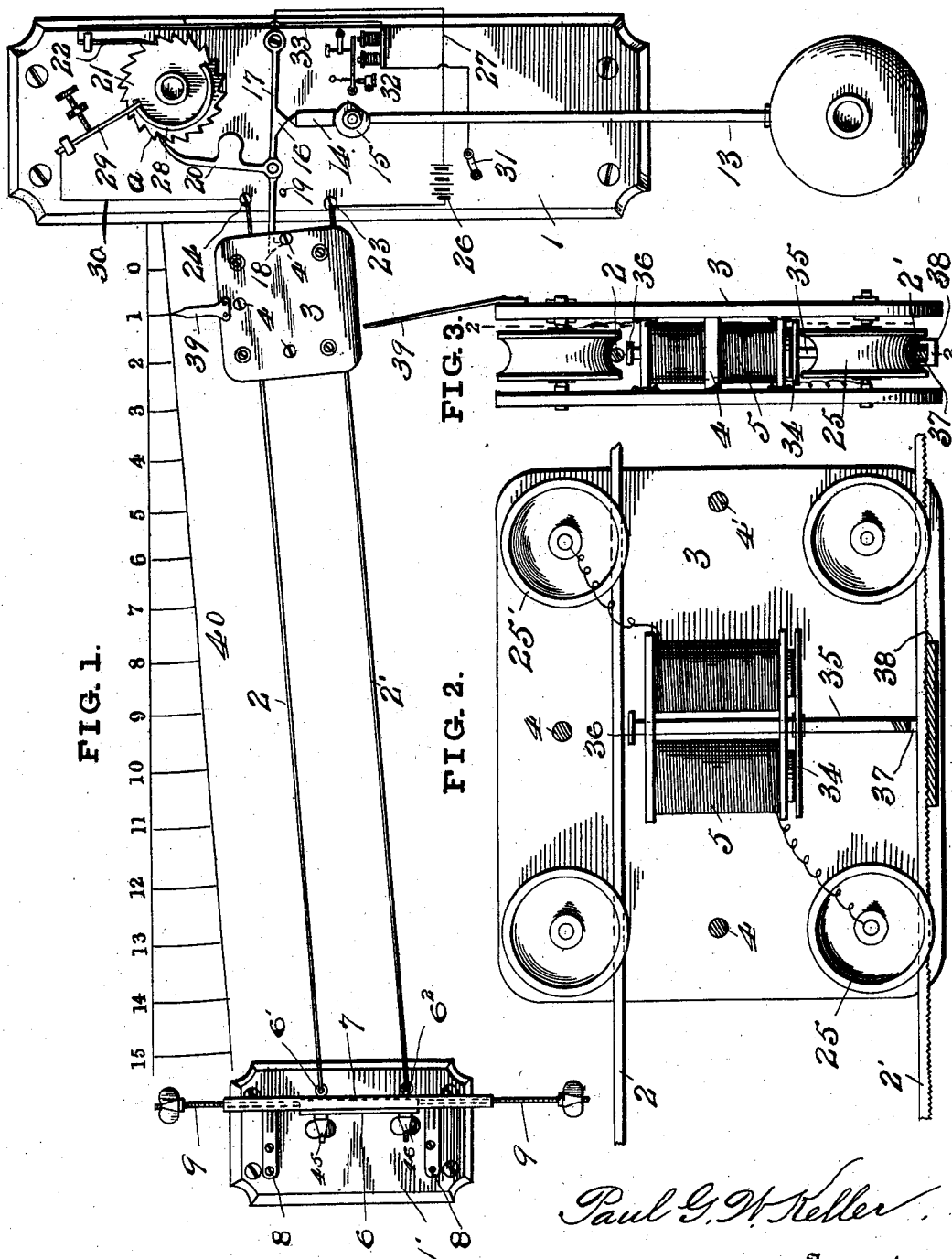
P. G. W. KELLER.

APPARATUS FOR ASCERTAINING THE ACCELERATION DUE TO GRAVITY.

APPLICATION FILED MAR. 5, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses

Chas. K. Davis.

W. O. Clements

Paul G. W. Keller.

Inventor

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No. 751,517.

PATENTED FEB. 9, 1904.

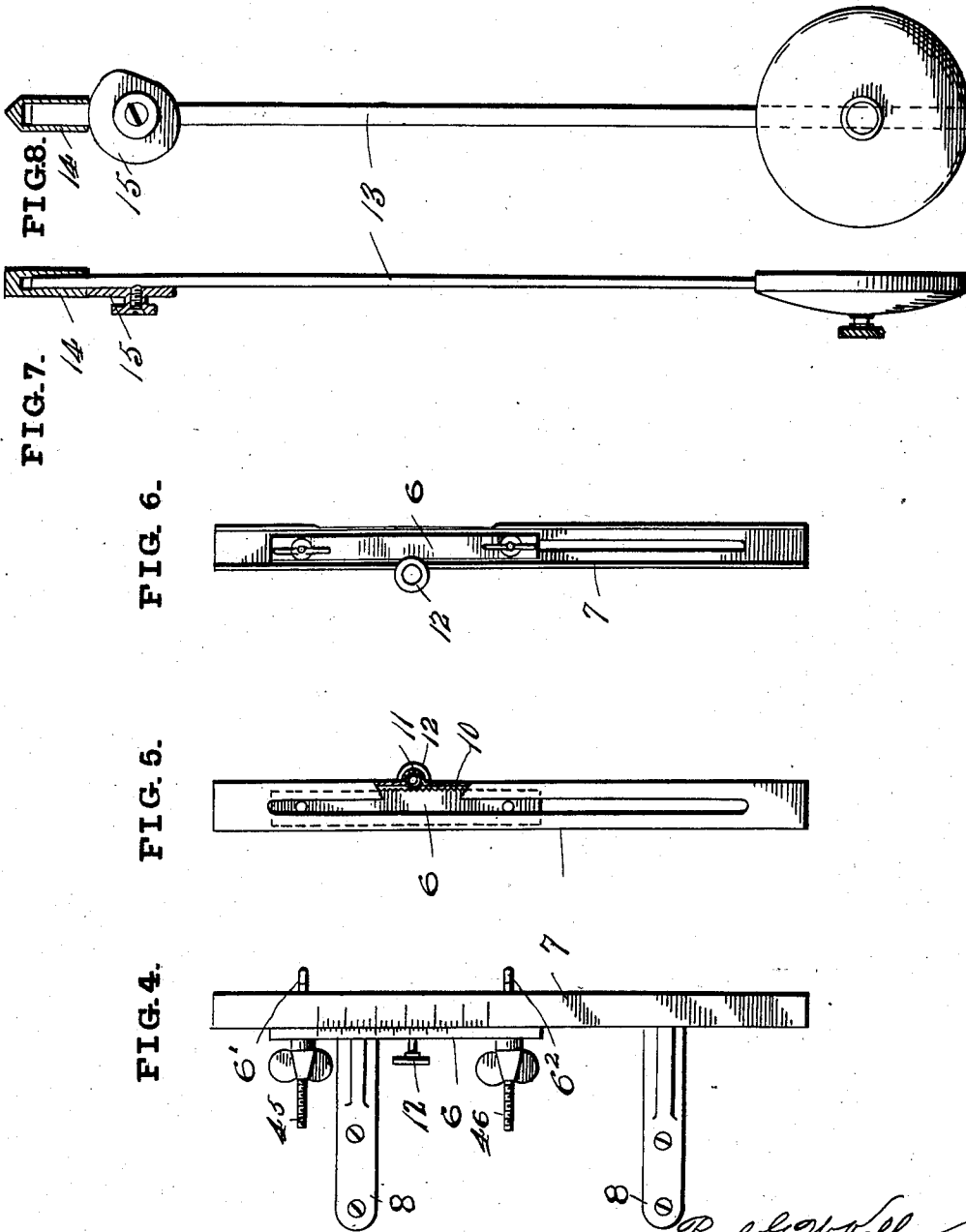
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UNITED STATES PATENT OFFICE.

PAUL G. W. KELLER, OF MANITOWOC, WISCONSIN.

APPARATUS FOR ASCERTAINING THE ACCELERATION DUE TO GRAVITY.

SPECIFICATION forming part of Letters Patent No. 751,517, dated February 9, 1904.

Application filed March 5, 1903. Serial No. 146,364. (No model.)

To all whom it may concern:

Be it known that I, PAUL G. W. KELLER, a citizen of the United States, residing at Manitowoc, in the county of Manitowoc and State of Wisconsin, have invented certain new and useful Improvements in Apparatus for Ascertaining the Acceleration Due to Gravity, of which the following is a specification.

My invention relates to apparatus for demonstrating the laws of acceleration and for finding the value of gravity.

The object of my invention is the provision of a scientific apparatus for enabling the computation of acceleration of a traveling body upon an incline, to find the value of the inclination from the horizontal of the track upon which the body travels, and from these the value of gravity for a given place; and the invention consists in the combination and arrangements of parts, as hereinafter described and claimed.

In the accompanying drawings, Figure 1 is an elevation of my apparatus as a whole. Fig. 2 is a section on line 2 2, Fig. 3. Fig. 3 is an end view of the traveling carriage. Figs. 4, 5, and 6 are views of the front and sides, respectively, of the adjustable track-terminal-holding block; and Figs. 7 and 8 are side and front elevations, partly in section, of the pendulum and body used in my apparatus.

In the drawings, the base-boards (designated as 1 1') are shown attached by screws or otherwise to suitable bases, as the side walls of a room. The base-boards are connected by a pair of wires 2 2', which for convenience may be called a "track." The lower one of the tracks 2' has a milled surface on its under side for a purpose to be described hereinafter. Traveling upon the rails is a carriage, as 3, provided with a suitable number of upper and lower supporting and guiding wheels, in this instance four being used. The carriage proper consists of two side plates connected by pins 4, as shown, or other suitable connecting means may be employed. Interposed between the walls of the carriage are the four supporting-wheels, and also an electromagnet 5 may be attached in any suitable manner to the side walls.

At the left in Fig. 1 the terminal of the

tracks 2 2' consists of an adjustable block 6, provided with tension-screws 45 and 46, having rings, which may be suitably insulated from the tracks by the use of a non-conducting lining, such as rubber, inside the rings. These rings 6' 6² are for attachment of the track-wires. The adjustable block 6 is mounted in a grooved or hollow supporting-piece 7, having brackets 8 8, which may be fastened to the base-boards 1'. The tracks or wires being rigidly fastened to the base-board 1 at the right of Fig. 1, they may be adjusted within limits to any inclination by means of the set-screws 9, acting upon the adjustable block 6, as shown in dotted lines, Fig. 1, in a manner which will be obvious from the drawings. A modification of the adjusting mechanism, which is the construction I prefer for attaining a desired inclination of the wires, is shown in Figs. 4, 5, and 6, wherein one edge of the adjusting-block 6 is provided with a milled or toothed surface 10, in which mesh the teeth of a wheel 11, suitably mounted in bearings upon the supporting-bracket 7, and by means of the wheel-head 12 said toothed wheel 11 may be turned, thus raising or lowering the adjustable block 6, and with it the suspended wires or tracks 2 2'.

The operating mechanism of my apparatus consists of a pendulum 13, suitably mounted upon the base-board 1 and provided with a cap 14, which I call the "starting-cap." Said cap may be thrown into or out of operating position by means of the cam-disk 15, as will be understood, and when in position during the vibration of the pendulum is adapted to contact with the point 16 of pivoted starting-lever 17. Said lever 17 has a hook 18 at its end, which engages the pin 4' of the traveling carriage 3 and normally holds said carriage at the starting-point. A pin 19 may be located on the base-board 1 to limit the movement of the lever 17. A pawl 20, having a suitable weight thereon, is pivoted to the starting-lever 17, and said pawl engages the teeth of a ratchet-wheel 21, mounted to rotate upon said base-board 1. A dog 22 may be provided to prevent backward movement of the ratchet.

To further secure the operation of my apparatus, I use the electrical connections shown

and which may be described as follows: The terminals 23 and 24 of the right-hand end of the metallic wires or tracks 2 2' may also be binding-posts having wires electrically connected with said tracks. At least two of the wheels, as 25 25', of the traveling carriage 3 are of metal and have conductors from their respective axles connected to the magnet 5, located in said carriage. The circuit is completed from the other side of the binding-posts 23 and 24 and through the battery, conductor 27 leading to the starting-lever 17, through said lever, pawl 20, wheel 21, elevated portion 28 of wheel 21, brush 29, and conductor 30, thence to the binding-post 24. If it is desired to use the pendulum as a "seconds-pendulum," I locate a key 31 and sounder 32 on the base-board and connect by conductor to the dog 22, insuring a click at intervals of a second as the dog 22 trips from cog to cog of the wheel 21, thus breaking the current, which breaks are registered by a click on the sounder.

The armature 34 of the magnet 5 is provided with a bar or rod 35. Said rod or bar passes through holes in the plates of the magnet, being prevented from dropping entirely through said openings by a head-piece 36. At the lower end of the rod or bar 36 I provide a transverse opening, through which opening passes the track 2'.

A block or plate 38 is formed integrally at the extreme end of rod 35, having its upper surface, a part of which constitutes a face of the opening 37, milled to correspond with the milled under surface of the track 2'. This plate or block 38 is adapted to engage with track 2' and thus stop the course of the carriage 3 after it has been started, in a manner to be described. A needle or pointer 39 of any suitable design may be attached to the carriage 3 and is adapted during the travel of said carriage to indicate upon a predetermined scale, as 40, the distance traveled by the carriage.

The preferable length of the track as I have used in practical demonstrations is about fifteen or twenty feet; but this distance can be varied according to existing conditions. The scale 40 should preferably be graded in centimeters, as indicated, and is marked off by arcs having their centers at the point of convergence of the horizontal line of the scale and the inclined line thereof, which will enable a reading of the scale no matter what the inclination of the track might be.

By means of the pendulum, starting-lever, and ratchet connections the carriage 3 is released when the pendulum reaches its vertical position during oscillation and after the apparatus has been set in gear by turning the eccentric disk 15, and if the wheel 21 is so set that the cog opposite a , Fig. 1, or any other tooth of the wheel, accordingly as the distance traveled during one, two, or three seconds or

other suitable unit of time is required, is engaging the ratchet the carriage will be stopped by means of the electrical connections at the end of the first second, as indicated by the needle 39 in Fig. 1, for as the pendulum returns it throws the elevated portion 28 of wheel 21 into contact with brush 29. This completes the circuit through the electromagnet 5 in the carriage 3, and the armature 34 draws the stop-block 38 upon or against the milled under surface of the track 2', thus stopping the movement of the carriage. The pointer 39 indicates the distance traveled by the carriage directly by reading to scale. This enables the computation of the value of acceleration for the given incline, as will be readily recognized by persons skilled in this art.

By means of the adjustable block 6 the amount of inclination from the horizontal can be read from the vernier-micrometer, as seen in Fig. 4. Knowing the length of the track as shown by the scale, the value of gravity is found at once from the formula $al \div d = g$, where d is the amount of inclination of the track, l the length of the track, a the acceleration determined for the inclination d , and g the value of gravity for the given place.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of a plurality of tracks, adjustable as to their inclination, with a traveling carriage thereon, and means for starting said carriage, and for stopping it at the end of a predetermined interval of time.
2. In an apparatus as described, a plurality of tracks, a traveling carriage thereon, a bracket at one end and a track terminal-block adjustable in said bracket as to height by means of a ratchet and wheel and a suitable support at the other end of said tracks, substantially as described.
3. An apparatus as described consisting of a plurality of tracks, a carriage traveling thereon, provided with a stop-block, and an electromagnet, said stop-block adapted to engage with said track or tracks when operated by the armature of said electromagnet.
4. A traveling carriage provided with suitable wheels and axles, a trackway, an electromagnet, a stop-block operated by said electromagnet and adapted to engage the trackway to stop the travel of the carriage upon which it is located, and suitable electrical connections to said magnet, combined substantially as described.
5. A traveling carriage as described, a trackway having a milled surface, an electromagnet, a rod provided with a milled portion connected to the armature of the magnet, and electrical connections to said magnet whereby said rod is operated by the movement of said armature to make engagement between the milled portions of the stop-block and the trackway.

6. A suitable trackway, a traveling carriage thereon, held in normal position by a pivoted lever, means for releasing carriage, an electromagnet, and a stop-block on the carriage
5 adapted to engage said trackway when operated by the armature of said electromagnet, substantially as described.

7. A traveling carriage held in normal position by a pivoted lever, and means for operating the lever to release said carriage, a
10 ratchet, a pawl connected to said lever and engaging said ratchet, an oscillating mechanism,

and electrical connections, whereby the movement of the oscillating mechanism causes a movement of the pawl and ratchet which in 15 turn operates a sounder located within the electrical connections.

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

PAUL G. W. KELLER.

Witnesses:

HELEN F. CARNIGHT,
ELLA E. HARRINGTON.