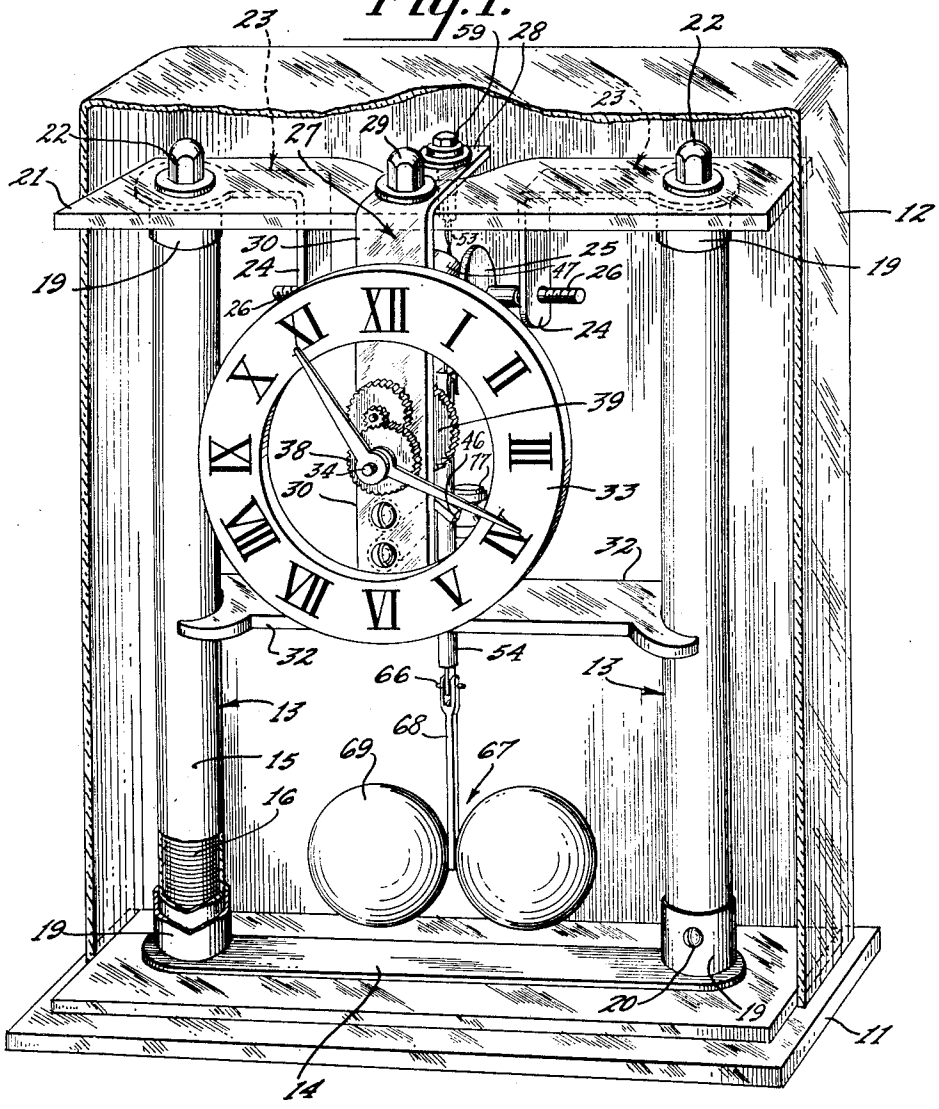
Jan. 20, 1953 I. REINER 2,625,787

ELECTRIC CLOCK

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Fig. 1.



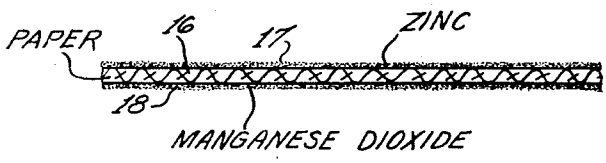


Fig. 8.

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Fig. 2.

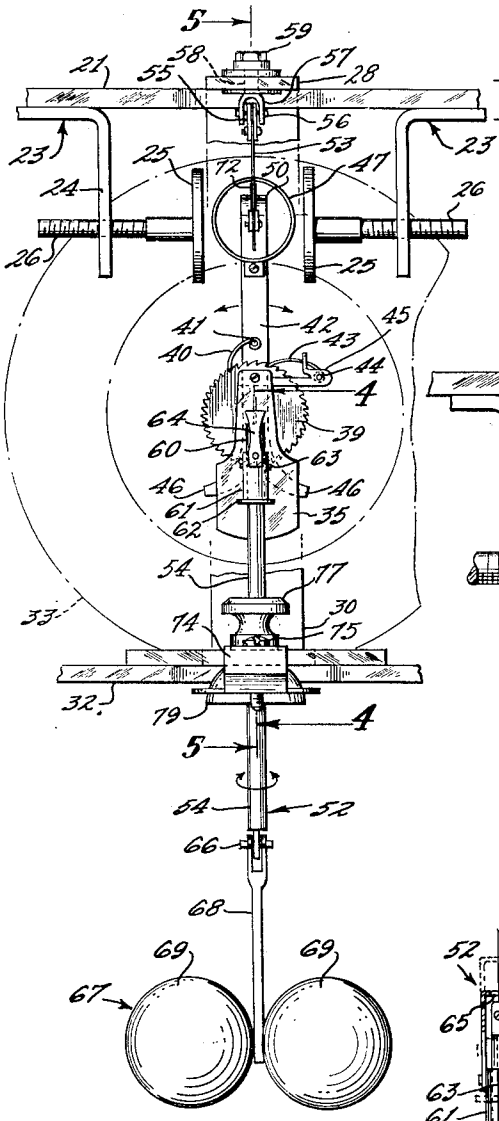
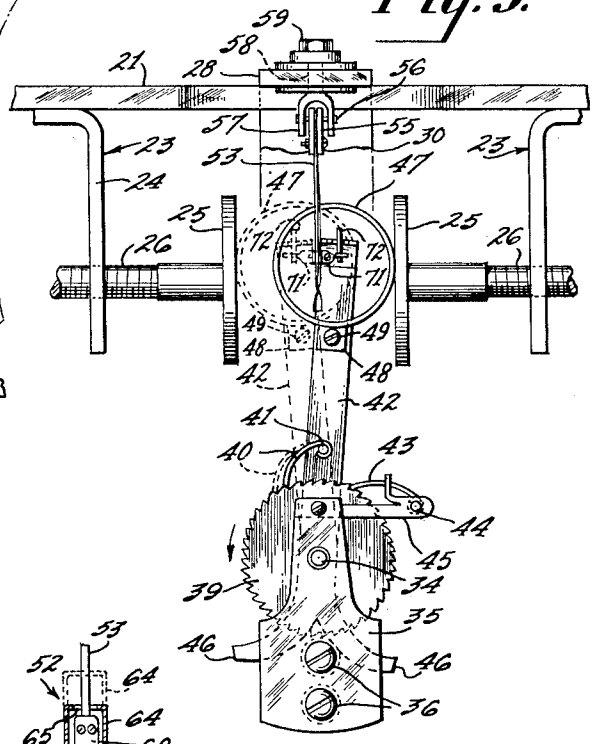


Fig. 3.



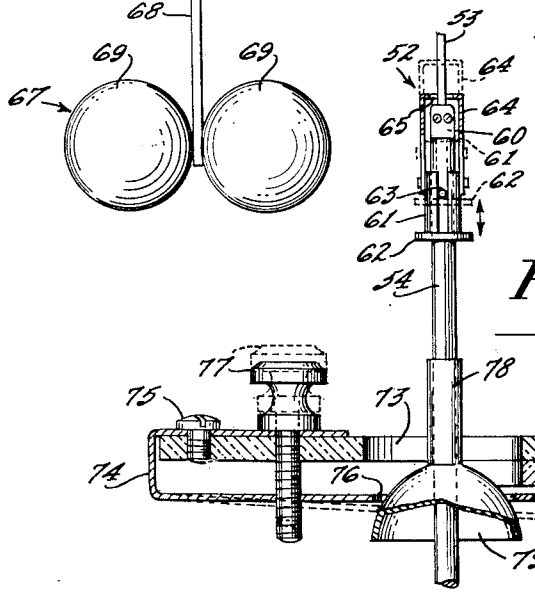


Fig. 4.

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ELECTRIC CLOCK

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Fig. 5.

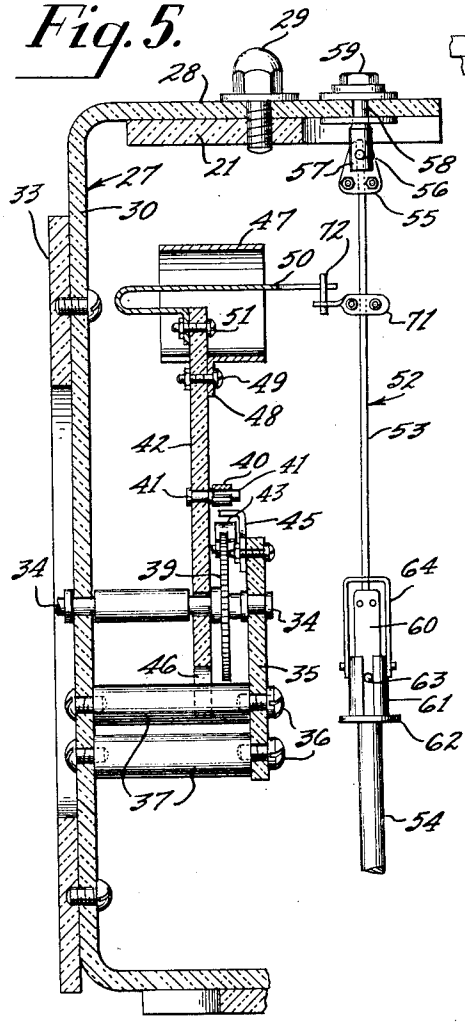


Fig. 6.

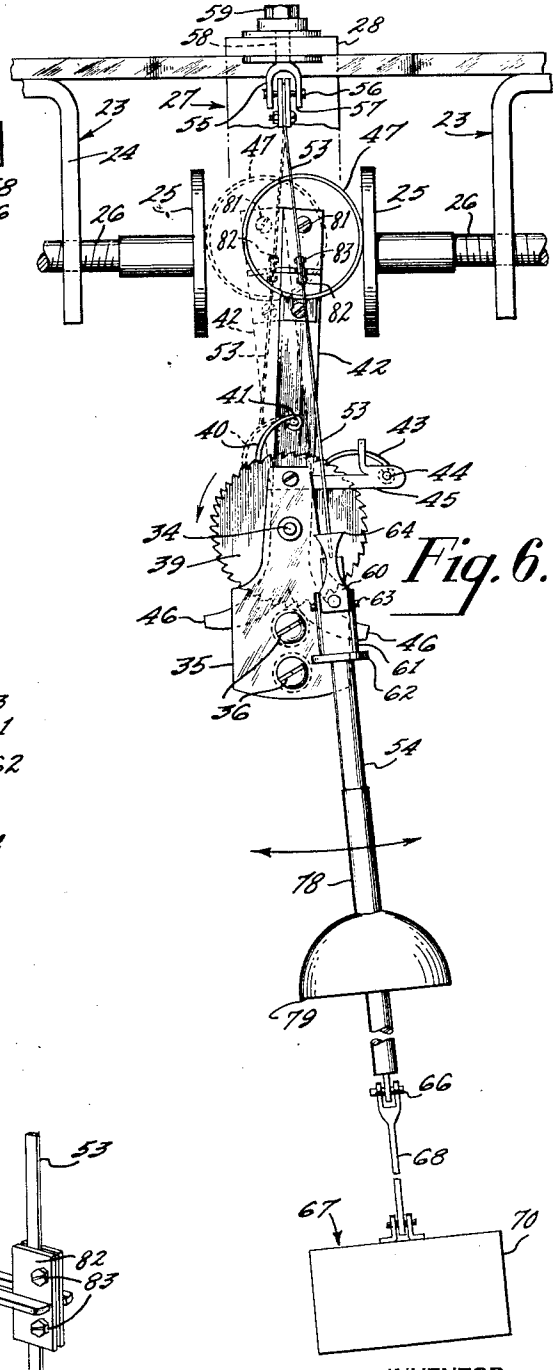
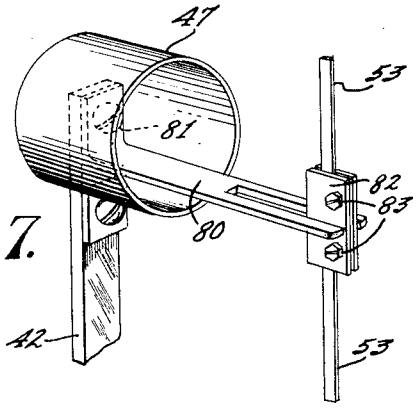


Fig. 7.



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UNITED STATES PATENT OFFICE

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ELECTRIC CLOCK

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Application September 28, 1951, Serial No. 248,762

7 Claims. (Cl. 58—30)

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This invention relates to an electric clock, and particularly to a battery-operated pendulum clock capable of use with either a simple or a torsion pendulum.

It is a primary object of the invention to provide a simple, sturdy, and efficient clock mechanism capable of long continuous use by the intermittent application to the pendulum of relatively slight forces.

Another object of the invention is to provide electrical means for imparting to the pendulum in a timed cycle the necessary forces for maintaining its continuous operation.

A further object is to provide for use in conjunction with the clock mechanism a simple battery comprising a plurality of voltaic cells so constructed and arranged as to supply a high terminal potential, in the order of about several thousand volts, with a negligible amperage, by reason of the high internal resistance of the battery.

A still further object of the invention is to provide a simple, compact, voltaic dry-cell capable of being arranged serially to form a battery of such dimensions as to readily fit within a clock case of the desired size and provide support for the clock mechanism, while at the same time being impervious to those factors which normally cause rapid deterioration of dry-cells and render them unsuitable for such long continued use.

These and other objects are effected by my invention, as will be apparent from the following description and claims taken in connection with the accompanying drawings forming a part of this application, in which:

Fig. 1 is a perspective elevational view of the clock, with the front portion of the case broken away to reveal the internal mechanism, and with a portion of one of the vertical supports or battery casings broken away to show the galvanic pile composed of series-connected disc-shaped voltaic cells;

Fig. 2 is a rear elevational view of the clock mechanism, arranged and adapted to be actuated by a torsion pendulum;

Fig. 3 is an enlarged view of the upper half portion of the structure shown in Fig. 2;

Fig. 4 is a side elevational view, in partial section, showing the details of a device provided to temporarily secure the pendulum while the clock is being transported;

Fig. 5 is an enlarged sectional view taken along the line 5—5 of Fig. 2;

Fig. 6 is a view similar to that of Fig. 2, but showing the clock mechanism arranged and

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adapted to be actuated by a simple pendulum;

Fig. 7 is an enlarged fragmentary perspective view showing the neutral cylinder and the fork member which transmits the movement of the simple pendulum, shown in Fig. 6, to the pivoted bar which actuates the ratchet-wheel; and

Fig. 8 is an enlarged fragmentary cross-sectional view of one of the voltaic cells.

Referring now to the drawings, the clock mechanism is shown supported on a base 11 of non-conductive material and enclosed within a casing 12, which for decorative purposes may be transparent.

A pair of horizontally-spaced elongated electric storage batteries 13 are secured at their lower ends to base 11. The batteries are elongated and extend vertically upwardly to additionally provide support for the clock mechanism. The lower ends of batteries 13 are connected by a flat conductor strip 14 which may be positioned either on top of or underneath the base 11, the latter arrangement being shown in the particular embodiment illustrated. Each battery 13 comprises a non-conductive cylindrical tube 15 filled with flat thin circular discs 16 of hygroscopic material, such as paper, each coated on one side with a layer 17 of manganese peroxide and on the other side with a layer 18 of zinc dust, as shown in Fig. 8, applied to the surfaces of the discs with a suitable bonding material, such as starch. The discs are placed one on top of the other to form a galvanic pile filling the tube 15, enough pressure being applied to maintain good contact between the discs. Each disc 16, a fragment of which is shown in Fig. 8, is an individual voltaic cell. The hygroscopic paper forming the electrolyte of each voltaic cell contains enough moisture to produce the desired chemical action, but not enough to cause deterioration of the battery. The ends of tubes 15 are covered and sealed against the admission of moisture, as by caps 19 of conductive material removably secured to the tubes by screws 20.

A cross-bar 21 of non-conductive material extends horizontally across the upper ends of battery posts 13 so as to rigidly connect the same and to form a sturdy support from which the clock mechanism may be suspended. The cross-bar 21 is removably attached to the upper caps 19 by threaded members 22.

Angle members 23 of conductive material are interposed between upper caps 19 and cross-bar 21 to provide supports for the electrodes. The angle members 23 extend horizontally along the underside of cross-bar 21 to spaced points between the upper ends of the battery posts, and then

downwardly, as at 24. Adjustable electrodes comprising a flat circular head portion 25 and a threaded axial body portion 26 are screwed in axial alinement through the vertical portions 24 of the angle members 23.

An irregular U-shaped support member 27, turned on its side, has its horizontal upper side portion 28 secured at the center of cross-bar 21 by threaded member 29. Horizontal portion 28 is perpendicular to cross-bar 21, and extends both forwardly and rearwardly thereof. The vertical base 30 of U-shaped support member 27 lies forward of the plane of battery posts 13. The horizontal lower side portion 31 of U-shaped member 27 extends rearwardly to a point a substantial distance in back of the plane of posts 13. Lateral extensions 32 extend horizontally from each side of portion 31 and have their outer curved ends abutting against the cylindrical surfaces of battery posts 13, so as to provide rigidity in the structure supporting the clock mechanism.

The face of the clock comprises a flat ring 33, which is secured in any suitable manner to the vertical base portion 30 of U-shaped member 27, and carries the numerals on its forward face.

The main shaft 34 projects through the central opening in the annular face of the clock and has a minute hand attached in conventional manner to its outer end. The forward part of main shaft 34 is journaled in the vertical portion 30 of U-shaped member 27, and the rear part is journaled in an elongated vertical support member which is attached at its lower end to the rear face of vertical portion 30 by means of screws 36 and spacers 37.

A conventional gear train located just forward of the front face of portion 30, and generally indicated at 38, is connected to both shaft 34 and the hour hand rotatably mounted thereon.

A ratchet-wheel 39 is rigidly secured to shaft 34 near its back end, and just forward of the vertical support member 35. The ratchet-pawl 40 of the ratchet-wheel is pivotally connected at 41 to an upwardly extending elongated bar 42 of non-conductive material. Bar 42 is rotatably mounted on the shaft 34 just forward of the ratchet-wheel 39. A ratchet-dog 43, which serves to prevent reverse rotary motion of the ratchet-wheel when the ratchet-pawl is dragged over the toothed surface to engage a new tooth, is pivotally connected at 44 to the free outer end of a bracket 45 which is attached at its inner end to the support member 35.

The lower end of elongated bar 42 is bifurcated, the branches 46 of the bifurcated portion extending downwardly on either side of the uppermost of spacers 37, and serving both to limit rotation of bar 42 to a relatively small arc on either side of the vertical, and to substantially counterbalance the upper elongated portion. The bar 42 is just slightly top-heavy, so that it may exert a slight force against the electrodes 25 when it reaches each end of its arcuate path.

A cylinder 47 of conductive material is attached to the upper end of bar 42, the cylinder being longitudinally slotted at one end to receive the upper end portion of bar 42. A tab 48 turned downwardly from the base of the slot is secured to the bar 42 by a screw 49.

In the particular embodiment of the invention illustrated in Figs. 1 to 5, a flat elongated fork member 50 is attached at one end by screw 51 to the upper end of bar 42. Member 50 projects forwardly to a point beyond the forward end of cylinder 47, then turns upwardly and horizontally rearwardly, passing entirely through and substantially beyond the rear end of the cylinder. The free end of member 50 is longitudinally slotted to form the forked portion.

A torsion pendulum, generally indicated by the numeral 52, is suspended at the rear end of the portion 28 of U-shaped member 27. The pendulum hangs in a vertical plane containing the axis of main shaft 34. The upper portion of the pendulum comprises a flat wire 53 of rectangular cross-section, and the lower portion comprises an elongated tubular member 54.

The upper end of wire 53 is held in a clamp-block 55 pivotally attached, as at 56, within the lower bifurcated portion 57 of a post 58. The upper end of post 58 passes through the portion 28 and is removably secured to the latter by threaded member 59.

The lower end of wire 53 is held in a second clamp-block 60, set in the upper end of tubular member 54. A split sleeve 61 is slidably mounted on the upper end of tubular member 54 and is flanged at its lower end to provide a finger grip 62. A set-screw 63 extending through the split portion of sleeve 61 into the side wall of tubular member 54 serves both to prevent independent rotation of the sleeve, and to maintain the latter in its set position. An inverted U-shaped strap 64 is attached at its ends to the upper end of sleeve 61 at diametrically opposite sides thereof. The horizontal base portion of the strap is provided with a longitudinal slot 65 through which the wire 53 passes. The width of the slot 65 is such as to receive the flat wire 53 only at its narrower dimension, thus preventing rotation or twisting of the portion of the wire held in the slot and the portion extending between the base of the strap and the lower clamp-block 60. Thus, by sliding the sleeve 61 longitudinally along the tubular member 54, the effective length of the wire as a torsion member may be varied, thereby changing the period of the pendulum.

The lower end of tubular portion 54 of the pendulum is provided with a diametrical pin 66, from which the pendulum weight, generally indicated by the numeral 67, is suspended by means of hook member 68 attached to the weight. The weight 67 may be of any convenient shape. For example, the pendulum weight illustrated in Figs. 1 and 2 comprises a pair of connected spheres 69, and the pendulum weight illustrated in Fig. 6 comprises a member 70 which may be a solid object of any desired configuration.

Referring to Figs. 2, 3 and 5, a clamp 71 is adjustably attached to the pendulum wire 53 at an intermediate point. The clamp 71 has a horizontal extension which projects forwardly to a point below the bifurcated end of forked member 50. A finger 72 is secured at its lower end to the extended portion of clamp 71 and projects upwardly between the tines of the fork. The engagement between finger 72 and the fork is such as to cause member 50, and with it elongated bar 42, to oscillate back and forth along a limited arcuate path about the axis of main shaft 34 when the finger 72 oscillates in a limited arcuate path about the axis of the wire 53 as a result of the wire being twisted.

The operation of the clock is as follows: The adjustable electrode members are set so that the flat circular head portions 25 provide limiting stops for the movement of cylinder 47 along its arcuate path, the spacing between the electrode members being such as to permit ratchet-pawl 40 to engage one tooth of ratchet-wheel 39 upon

completion of its backward movement and to rotate the ratchet-wheel the arcuate distance of one tooth during its forward movement. As will readily be understood by those skilled in the art, the ratchet-wheel may be provided with any desired and suitable number of teeth, and the period of the pendulum may be so adjusted as to rotate the ratchet-wheel at the proper rate. To start the clock, the pendulum is preferably rotated by hand a fraction of a full turn.

As the wire 53 twists, the finger 72 moves along its arcuate path about the axis of the wire, carrying forked member 50 with it. Since forked member 50 and cylinder 47 are attached to pivoted bar 42, they move as an integral unit along an arcuate path about the axis of shaft 34 until cylinder 47 comes in contact with one of electrode portions 25. Since the batteries are series connected, one disc 25 is positively charged and the other is negatively charged. The cylinder 47, being neutral, picks up the charge of the electrode with which it comes in contact and is immediately repelled, by reason of the similarity of charge. The slight impulse is transmitted to the pendulum wire through the fork and finger connection, and is sufficient to overcome the forces tending to cause deceleration of the pendulum.

As the wire untwists and winds in the opposite direction, the finger 72 carries the cylinder 47, with the charge it has just received, over to the opposite electrode portion 25, which is oppositely charged. Upon contact with the latter, the cylinder 47 gives up its charge and takes on a charge of opposite polarity. Again, the like charges in the cylinder and in the electrode cause them to repel each other, and the cylinder is given an impulse in the opposite direction. The repeated impulses given to the cylinder 47 upon each contact with an electrode is sufficient to keep the pendulum rotating indefinitely. Under the action of the repeated impulses given to the cylinder the pendulum will either accelerate or decelerate until its proper arc of movement is reached, depending upon whether the pendulum was given too little or too much rotation in starting the clock.

In order that the clock may easily be transported without danger of injury to the pendulum, a locking device is provided to rigidly secure the pendulum in its vertical position. For this purpose the lower side portion 31 of U-shaped support member 27 is provided with an opening 73 concentric to and adapted to provide free passage of the tubular portion 54 of the pendulum.

A U-shaped resilient member 74 is placed sideways on the end of portion 31, so that the latter is inserted between the sides of the member 74. The upper side of member 74 rests upon portion 31 and is secured thereto by a screw 75. The base of member 74 passes around the end of portion 31, and its lower side extends inwardly below and vertically spaced from the member 31. The forward end of the lower side of member 74 is provided with a relatively large circular opening 76 having its center approximately on the vertical axis of the pendulum. A thumb-screw 77 extends downwardly through the upper side of member 74 and through portion 31, and has its threaded lower end set in the lower side of member 74, so that tightening of the screw 77 will cause the resilient lower side to be pulled upwardly from its normal position against the spring action.

A split sleeve 78 is mounted on the tubular portion 54 of the pendulum. A downwardly divergent flange or skirt 79 is attached to the lower end of split sleeve 78 and passes concentrically through the opening 76. The arrangement is such that the release of the resilient member by loosening the thumb-screw 77 causes the flange or skirt to seat tightly within the opening 73, thereby preventing lateral or longitudinal displacement of the body portion of the pendulum. The pendulum weight may then be left to hang suspended from pin 66 at the fixed lower end of tubular member 54, or it may be unhooked and removed for separate transportation.

Referring to Figs. 6 and 7, I have shown a modification of the apparatus which adapts it for use with a simple pendulum. In this modification, the opening or clearance in the lower portion 31 of support member 27 is sufficient to permit the pendulum to swing freely through the necessary arc. A modified form of fork 80 is attached to the upper end of member 42 by a screw 81, the tines of the fork passing to either side of the pendulum wire. A wear block 82 clamped to the wire 53 by screws 83 engages the tines of the fork to prevent injury to the wire. As the pendulum swings back and forth, the forked member 80 carries the cylinder back and forth between the electrodes, the latter being set so that the cylinder just makes electrical connection therewith at each end of the swing.

Since the wire passes between the tines of the fork 80 a radial force is exerted against the wire rather than a twisting force. The repeated impulses given to the wire in this case maintain continuous movement of the simple pendulum.

While I have shown my invention in but two forms, it will be obvious to those skilled in the art that it is susceptible to various other changes and modifications within the spirit of the invention, and I desire therefore that only such limitations shall be placed thereon as are specifically set forth in the appended claims.

What I claim is:

1. In a clock having a ratchet-wheel for actuating the clock hands and a pendulum for rotating said ratchet-wheel, the combination of a pivoted bar adapted to rotate freely about the axis of said ratchet-wheel, a ratchet-pawl pivotally secured to said bar and adapted to impart rotary motion to said ratchet-wheel in one direction, a forked member attached to the free end of said bar and engageable at its forked end with said pendulum, whereby oscillation of said pendulum causes concomitant oscillation of said bar, a contact member attached to the free end of said bar and insulated from all other portions of the clock, a pair of series connected batteries, and electrode members connected to opposite poles of said batteries and arranged on both sides of said bar in the path of movement of said contact member, said electrodes forming stops to limit the rotation of said bar.

2. Apparatus as defined in claim 1 in which said pendulum is a simple pendulum having its plane of movement parallel to the plane of movement of said bar and in which the branches of said forked member pass on each side of said pendulum and are arranged to oscillate therewith without substantial lost motion.

3. Apparatus as defined in claim 1 in which said pendulum is a torsion pendulum having a vertical axis of rotation, and including a member attached to said torsion pendulum and extending radially outwardly from the axis thereof, said member being engageable at its outer end with

said forked member, whereby the oscillation of said torsion pendulum about its vertical axis causes oscillation of said bar about its horizontal axis through the interengagement of said radially extending member and said forked member.

4. Apparatus as defined in claim 3 in which the portion of said pendulum containing said radially extending member comprises a relatively thin flat wire of rectangular cross-section.

5. Apparatus as defined in claim 4 including means for varying the effective length of said flat wire.

6. Apparatus as defined in claim 1 in which the portion of said pendulum engageable with said forked member comprises a relatively thin wire.

7. In a clock having a ratchet-wheel for actuating the clock hands and a pendulum for rotating said ratchet-wheel, the combination of a pivoted bar adapted to rotate freely about the axis of said ratchet-wheel, a ratchet-pawl pivotally secured to said bar and adapted to impart rotary motion to said ratchet-wheel in one direction, means at the free end of said pivoted bar engageable with said pendulum, whereby oscillation of said pendulum causes concomitant oscillation of said bar, a contact member attached to the free end of said bar and insulated from all other portions of the clock, a pair of series connected batteries, and electrode members connected to opposite poles of said batteries and arranged on both sides of said bar in the path of movement of said contact member, said electrodes forming stops to limit the rotation of said bar.

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