Aug. 17, 1943. H. K. SANDELL 2,327,319

CLOCK MECHANISM

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Fig-1

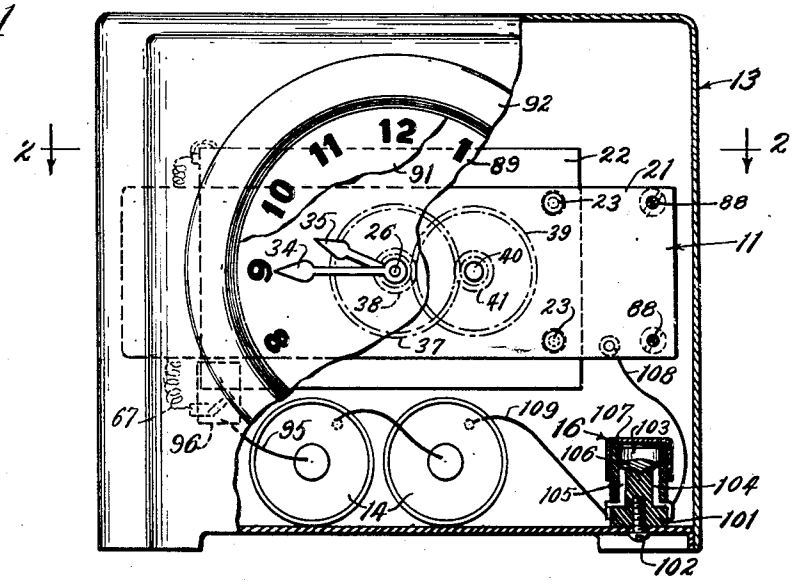


Fig-2

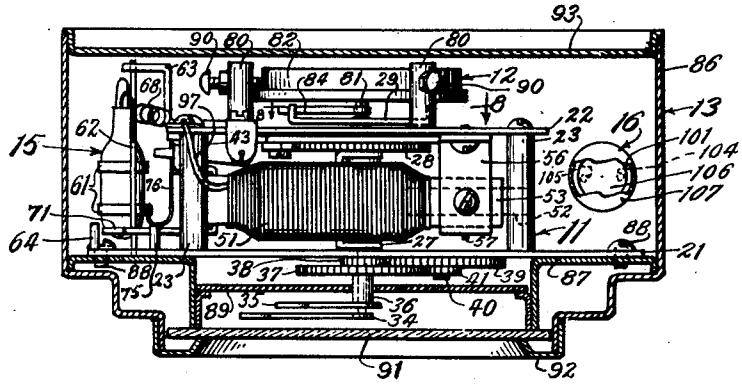
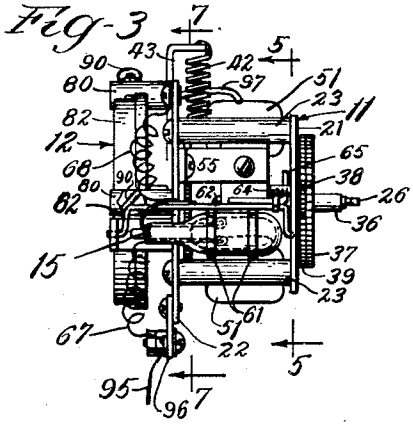


Fig-3



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Fig-4

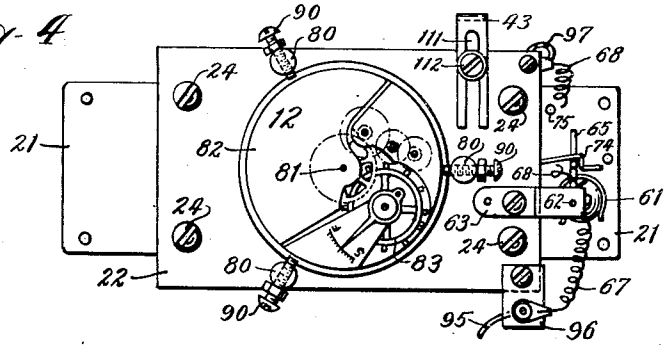


Fig-5

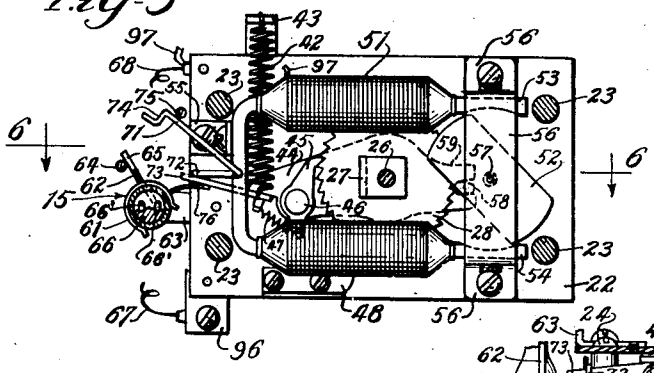


Fig-6

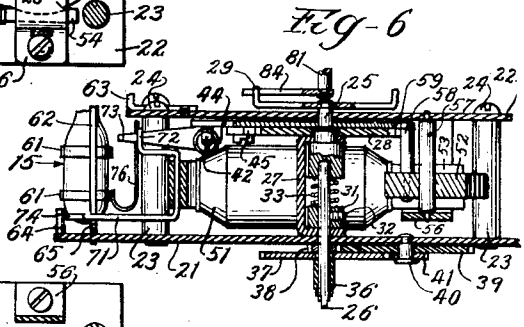


Fig-7

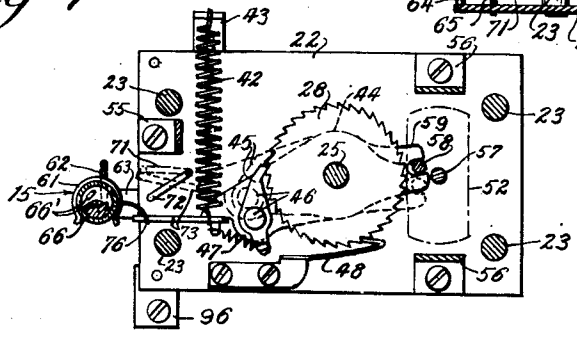
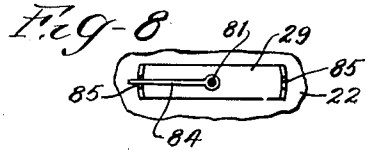


Fig-8



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Patented Aug. 17, 1943

2,327,319

UNITED STATES PATENT OFFICE

2,327,319

CLOCK MECHANISM

Henry K. Sandell, Sister Bay, Wis.

Application January 29, 1940, Serial No. 316,114

2 Claims. (Cl. 58—23)

This invention relates in general to a clock mechanism and more particular to such a mechanism of the electrically operable type.

An important object of the invention is to provide a durable and economical clock mechanism and an efficient control therefor which cooperate to produce a long lasting and efficient clock mechanism economically.

Other objects will be further apparent when the invention is better understood from the following description, which, taken in connection with the accompanying drawings discloses an embodiment thereof.

Referring to the drawings:

Figure 1 is a front elevational view of a clock embodying the invention.

Fig. 2 is a plan section taken substantially on line 2—2 in Fig. 1, showing details of construction and the arrangement of the parts.

Fig. 3 is an end elevational view of the mechanism only of the clock shown in Fig. 1 and as viewed from the left in that figure.

Fig. 4 is an elevational view showing the back of the mechanism shown in the clock in Fig. 1.

Fig. 5 is a sectional view taken substantially on line 5—5 in Fig. 3 illustrating details of construction and operation of the clock mechanism.

Fig. 6 is a plan section taken substantially on line 6—6 in Fig. 5 further illustrating details of construction.

Fig. 7 is a vertical section taken substantially on line 7—7 in Fig. 3 illustrating the drive connection; and,

Fig. 8 is a section taken substantially on line 8—8 in Fig. 2 illustrating the drive connection with the governor.

To illustrate the invention I have shown a mechanism assembly 11 having a governor 12 attached thereto and mounted in a case 13, dry cell batteries 14 for actuating the mechanism, a mercury switch 15 for controlling operation and a master switch 16 for protection and permitting transportation or manipulation of the clock.

The mechanism assembly 11 includes frame plates 21 and 22 suitably spaced apart and secured together by means of a plurality of spacing posts 23 riveted to the plate 21 and registering the plate 22 with respect thereto. Suitable screws 24 are provided to secure the plate 22 to the posts 23. An electrically operable intermittent motion mechanism is supported between the plates 21 and 22 for actuating an indicator shaft extending across between and through the plates 21 and 22. The indicator shaft illustrated in Figs. 5, 6, and 7 is of sectional construction to facilitate setting of the hands without disturbing the operation of the mechanism and includes a driving section 25, a driven section 26, and a U shaped connecting yoke 27. The driving section 25, together with a suitable drive disc 28 is riveted to one leg of the yoke and extends through the plate 22 to receive a drive link 29 by means of which the shaft may be rotated.

The driven section 26 of the indicator shaft is rotatably seated in an end of the driving section 25 and extends in axial alignment therewith through the other leg of the yoke 27 and through the frame plate 21 for receiving and carrying indicators or the like.

The section 26 is frictionally driven from the section 25 through a collar 31 secured thereto by a means of a set screw 32 and pressed into frictional engagement with a leg of the yoke 27 by a helical compression spring 33 seated against the end of the shaft section 25.

The projecting end of the section 26 is key formed to receive a minute hand or indicator 34, Figs. 1, 2, and 6, and an hour hand or delayed indicator 35 may be similarly secured to a sleeve 36 rotatably mounted on the shaft section 26 and carrying a gear 37. The gear 37 attached to the sleeve 36 is rotated by a pinion 38 pressed onto the shaft section 26 and through an idler gear 39, pivoted to rotate adjacent the section 26 on a bearing pin 40 and carrying a pinion 41 engaged with the gear 37. The above mentioned gears and pinions are proportioned to effect a reduction of twelve to one where the indicator 35 is to indicate hours.

The indicator shaft is driven in a clockwise direction by a tension spring 42 engaged with a suitable adjusting bracket 43 and with a bell-crank lever 44 which is arranged between the drive disc 28 and the plate 22 and pivoted for rotational movement on the shaft section 25 as shown in Figs. 5, 6, and 7. A drive pawl 45 pivotally attached to the lever 44 by means of a shoulder rivet 46 in position to engage suitable ratchet teeth formed in the periphery of the drive disc 28 forms a one way drive connection between the spring 42 and the indicator shaft.

A tension spring 47 yieldingly connecting the pawl 45 with the lever 44 as shown in Fig. 7 engages the pawl with the ratchet teeth on the drive disc 28 and permits backward movement of the pawl, and a suitable yielding pawl 48 secured to the plate 22 and engaging the ratchet teeth of the disc 28 prevents counter-clockwise movement thereof and of the indicator shaft.

To sustain the action of the spring 42 it is essential that lever 44 be periodically reset to restore tension to the spring and for uniformity of operation it is desirable to confine this reset movement to a relatively short arc as indicated in Fig. 7. Therein the lever is shown in solid lines and in dotted lines, each illustration indicating an extremity of movement.

Accordingly electrically operable means is provided for periodically resetting the lever 44 to restore tension to the spring 42. This means includes a U shaped electromagnet 51 and an armature 52 therefor pivotally supported for oscillatory movement between pole terminals 53 and 54 of the magnet 51. The magnet 51 is supported in operative relationship by means of brackets 55 and 56 attached to the plate 22 and to the magnet by means of screws or the like. The brackets 55 and 56 are formed of nonmagnetic material and the bracket 56 cooperates with the plate 22 to form pivot bearings for a shaft 57 carrying the armature 52. An operating pin 58 extends from the armature 52 to engage a bifurcated end 59 of the lever 44 for coordinating operation thereof.

To control operation of the electromagnet I have shown the mercury tube switch 15 mounted and controlled so that the make and break will both be rapid or sudden so as to minimize normal deteriorating effects. Spaced spring clamps 61 are suitably secured, such as by welding, to a wire frame 62 which is shaped to pivot in suitable aligned apertures formed in the frame plate 21 and in a support bracket 63 mounted on the plate 22.

The wire frame 62 is shaped so that when a mercury switch tube such as the tube 15 is engaged in the spring clamps 61 and the frame is held perpendicularly as shown in Fig. 7, the pivot points of the frame will be located at one side or the other of the axis of the mercury tube. Due to this arrangement the greater portion of the weight of the tube 15 is carried on the left side of the pivot points of the frame 62, as indicated in Figs. 6 and 7, and upon release of the frame 62 the tube responds to gravity and moves in a counter-clockwise direction about the pivot points of the frame 62 to the position shown in Fig. 5 where further movement is prevented by a stop pin 64 mounted on the frame plate 21 and engaging an upwardly extended portion 65 of the frame 62.

The mercury switch 15 illustrated is an elongated hollow glass bulb, containing a quantity of liquid mercury 66, in one end of which a pair of contact elements 66' are supported in parallel relationship and so as to be bridged by the mercury only when the tube is arranged in the frame 62 as shown in Fig. 5. Fine spiral or flexible wires 67 and 68 are attached to the contact elements 66' and connected in circuit with the batteries 14 as will be later described.

A latch device is provided for normally holding the switch 15 in the position shown in Fig. 7 and this device is arranged so as to be disengaged by the lever 44 when in the position shown by dotted lines.

To provide such a latch device I have shown a wire 71 extending through and having a bearing in the core of the electromagnet 51. One end of the wire 71 is twice bent at right angles to form a laterally disposed extension 72 arranged to extend over or in the path of movement of a finger 73 formed on or extending from the lever 44. The other end of the wire 71 is bent to extend at a right angle to the bearing portion thereof and its extremity is bent to form a depending hook 74 for engaging the wire frame 62 to normally hold the switch 15 in the off position as shown in Figs. 4, 6, and 7. A stop pin 75 mounted in the plate 21 limits the upward movement of the hook 74 as shown in Fig. 5.

A relatively fine wire spring 76 which is welded or otherwise secured to one of the spring clamps 61 is arranged to extend beneath or in the path of movement of the finger 73 of the lever 44 so as to yieldingly urge the switch 15 in a clockwise direction or toward the normal position upon downward movement of the lever 44.

The governor 12 may be any suitable device or mechanism capable of chronometrically retarding or controlling the rotary movement of the indicator shaft, such as a balance wheel escapement mechanism or a pendulum mechanism of the type now in common use in watches and clocks, and to provide such a mechanism I have shown a partly assembled watch mechanism in Figs. 2, 3, and 4, including a drive spindle 81 rotatably supported in a frame 82 of the type in common use in watches and operably connected to a balance wheel escapement mechanism indicated at 83 through a diagrammatically indicated gear train so that rotation of the spindle 81 is subject to the retarding or controlling action of the balance wheel escapement mechanism exactly the same as the hand carrying stem of a watch or clock is governed or controlled by the same or a similar mechanism.

A laterally extending arm 84 is rigidly secured to the projecting end of the spindle 81 for engaging in one or the other of the two slots 85 formed between upturned end portions of the drive link 29 carried by the indicator shaft of the mechanism assembly 11, as shown in Fig. 8, and together with the link 29 forms a separable or interengaged drive connection whereby rotation of the shaft is rendered subject to the governed rotary movement of the spindle.

To provide for detachment of the governor 12 to facilitate repairs or the substitution of another governor therefor, I have shown a plurality of mounting posts 89 radially spaced and rigidly mounted on the frame plate 22 and having set screws 90 threaded therein and arranged to rigidly secure the frame 82 in operative relationship as shown in Fig. 4.

The case 13 illustrated includes an ornamental shell 86 having a header or frame 87 secured therein to which the mechanism 11 may be secured by means of screws 88, a dial 89, a glass front plate 91 secured against the frame 87 by means of a slip ring 92 and through which the dial and indicators may be observed, and a suitable back closure or cover 93.

While the clock may be actuated from an external power source through suitable conductors and connections, the batteries 14 illustrated are of the dry cells type so that the clock may be manipulated without injury and does not require electrical connections.

Two cells of the battery are shown connected in series and a wire 95 connects the batteries through the wire 67 and a properly insulated terminal 96 to the switch 15. The wire 68 extending from the switch 15 is similarly connected through a wire 97 to the windings of the electromagnet 51 and these windings are suitably grounded, either to the core of the magnet or the frame plates. A complete and operable electrical

circuit may then be formed by grounding the batteries to the mechanism 11 or to the case 13.

Means is provided for protecting the clock in the event of manipulation or transportation against such damage as may be caused by a continuously closed electrical circuit such as may occur when the clock is inadvertently tilted to such an angle that the mercury 66 will constantly remain about the contact elements 66' of the mercury switch 15. To accomplish this I have shown the master-switch 16, Figs. 1 and 2. This switch is formed of a body 101, of suitable insulating material secured to the bottom wall of the case 13 in an upright position, having a cup or well 103 formed in the top thereof and having electrodes 104 and 105 molded therein as inserts and to terminate at remote or widely spaced positions in the cup 103 so that a small body of mercury 106 contained in the well 103 will bridge the electrodes only when the clock is in a substantially level position. A cover or cap 107 may be applied to retain the mercury in the event of extreme tilting.

The electrodes 104 and 105 are exposed near the base of the body 101 and a suitable wire 108 connects the electrode 104 with the mechanism 11 while a wire 109 similarly connects the electrode 105 with the batteries 14 so that the master switch 16 is included in and dominates the electrical circuit above described.

In operation the spring 42 drives the indicator shaft in a clockwise direction through the pawl 45 engaging the ratchet teeth formed on the drive disc 23 until the finger 73 of the lever 44 lifts the hooked end 74 of the wire 71 out of holding engagement with the wire frame 62, thus releasing the switch 15 as shown in Fig. 5 so that it may respond to gravity and shift from the open circuit position shown in Fig. 7 to the closed circuit position shown in Fig. 5.

Coincidental with the switch releasing movement of the lever 44 the armature 52 of the electromagnet 51 is rotated about the shaft 57 in a counter-clockwise direction and to the position shown in Fig. 5 by means of its connection with the lever 44 through the bifurcated end 59 thereof and the pin 58 carried by the armature 52.

At the instant the switch 15 is closed the electromagnet is energized by means of the electrical circuit above described and a flow of magnetic flux is established between the poles 53 and 54 of the electromagnet. This pulls the armature 52 into alignment with the poles 53 and 54 or to the position indicated by dash and dot lines in Fig. 7 and consequently returns the lever 44 to the solid line position shown in that figure.

In returning to the starting position the pawl 45 carried by the lever 44 slips over the teeth of the drive disc 23 while retrograde movement thereof is prevented by the holding pawl 48 and pressure is applied to the spring 76 by the finger 73 of the lever 44 until the applied pressure exceeds the unbalanced weight of the switch 15, thereafter the switch 15 snaps up to engage the frame 62 thereof under the hook 74, opening the electrical circuit to permit the spring 42 to continue or repeat its driving action.

The above described operation is repeated at uniform intervals in the manner of an intermittent motion mechanism and may be adjusted to requirements by varying the number of ratchet teeth in the drive disc 28 and the form or arrangement of the hook 74 accordingly.

The adjusting bracket 43 is preferably arranged for adjustment relative to the top of the plate 22 so that the tension of the spring 42 may be adjusted upon occasion and to permit this a slot 111 is provided through which a mounting screw 112 may extend. Adjustment is effected by extending the bracket until the proper tension is applied after which the screw 112 is turned in tight to secure the bracket.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in form, construction, and arrangement of the parts without departing from the spirit and scope of the invention, or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

What I claim and desire to secure by Letters Patent is:

1. For association with an electrically operable clock mechanism, a mercury switch for determining operation thereof supported adjacent said clock mechanism in unbalanced relationship and for rotary movement about an axis of rotation located parallel to and adjacent the longitudinal axis thereof, said mercury switch being biased to rotate on the axis of rotation thereof into circuit closing relationship when free, restraining means whereby said mercury switch is normally held in open circuit or inoperative relationship, and periodically operable release means arranged for actuation by the clock mechanism whereby said restraining means is periodically actuated to permit closing movement of said switch, said release means being arranged to intermediately restore said switch to open circuit relationship in engagement with said restraining means.

2. For association with an electrically operable clock mechanism, a mercury switch for determining operation thereof supported adjacent said clock mechanism in unbalanced relationship and for rotary movement about an axis of rotation located parallel to and adjacent the longitudinal axis thereof, said mercury switch being biased to rotate on the axis of rotation thereof into circuit closing relationship when free, restraining means whereby said mercury switch is normally held in open circuit or inoperative relationship, and periodically operable release means arranged for actuation by the clock mechanism whereby said restraining means is periodically actuated to permit closing movement of said switch, said release means acting through a yielding connection with the switch to intermediately restore same to engagement with the restraining means in open circuit relationship.

HENRY K. SANDELL.