943,933.

H. O. HARRISON.

ELECTRIC CLOCK SYSTEM.

APPLICATION FILED MAR. 16, 1909.

Patented Dec. 21, 1909.

3 SHEETS—SHEET 1.

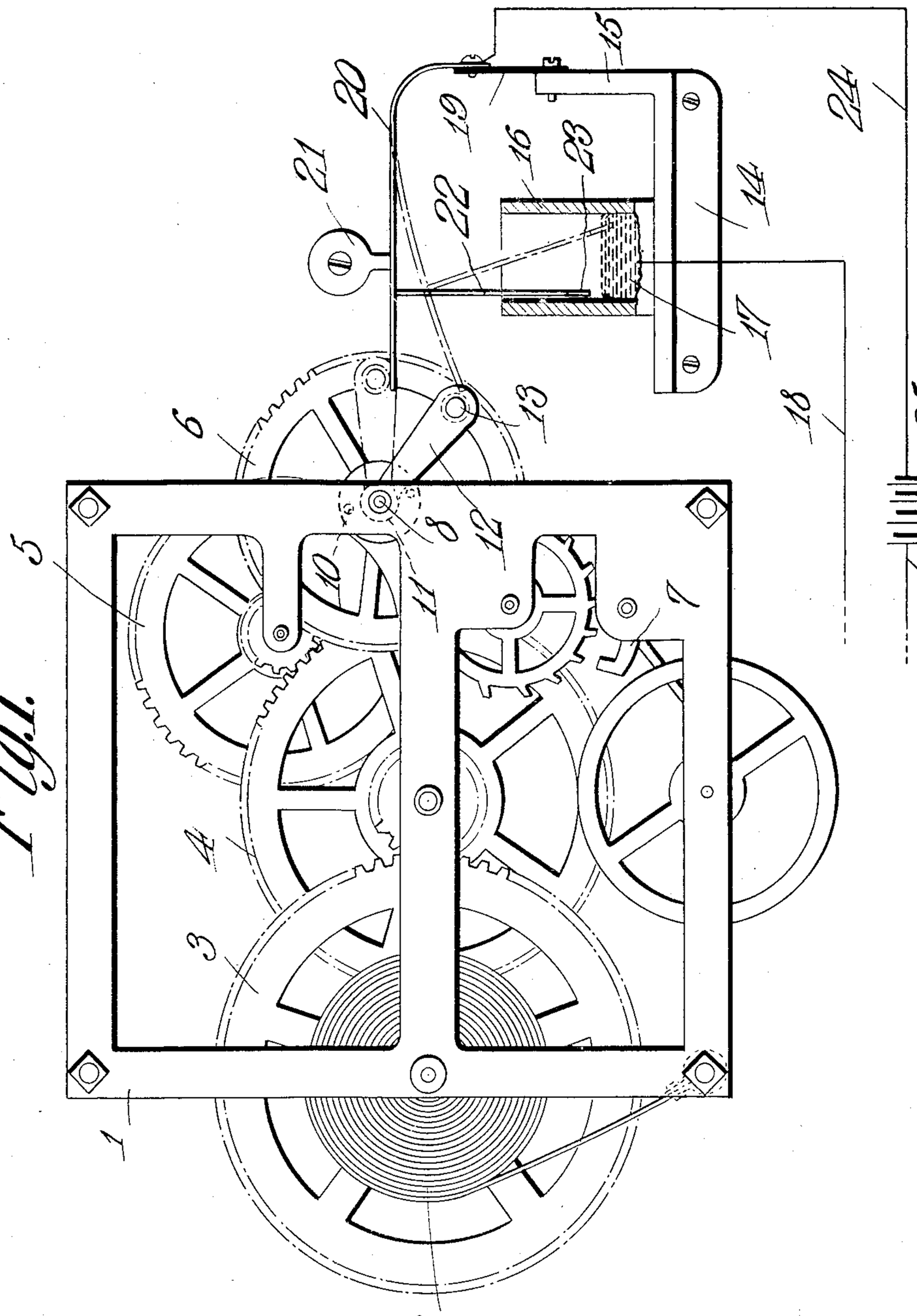

Fig. 1.

Witnesses

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3 SHEETS—SHEET 2.

Fig. 3.

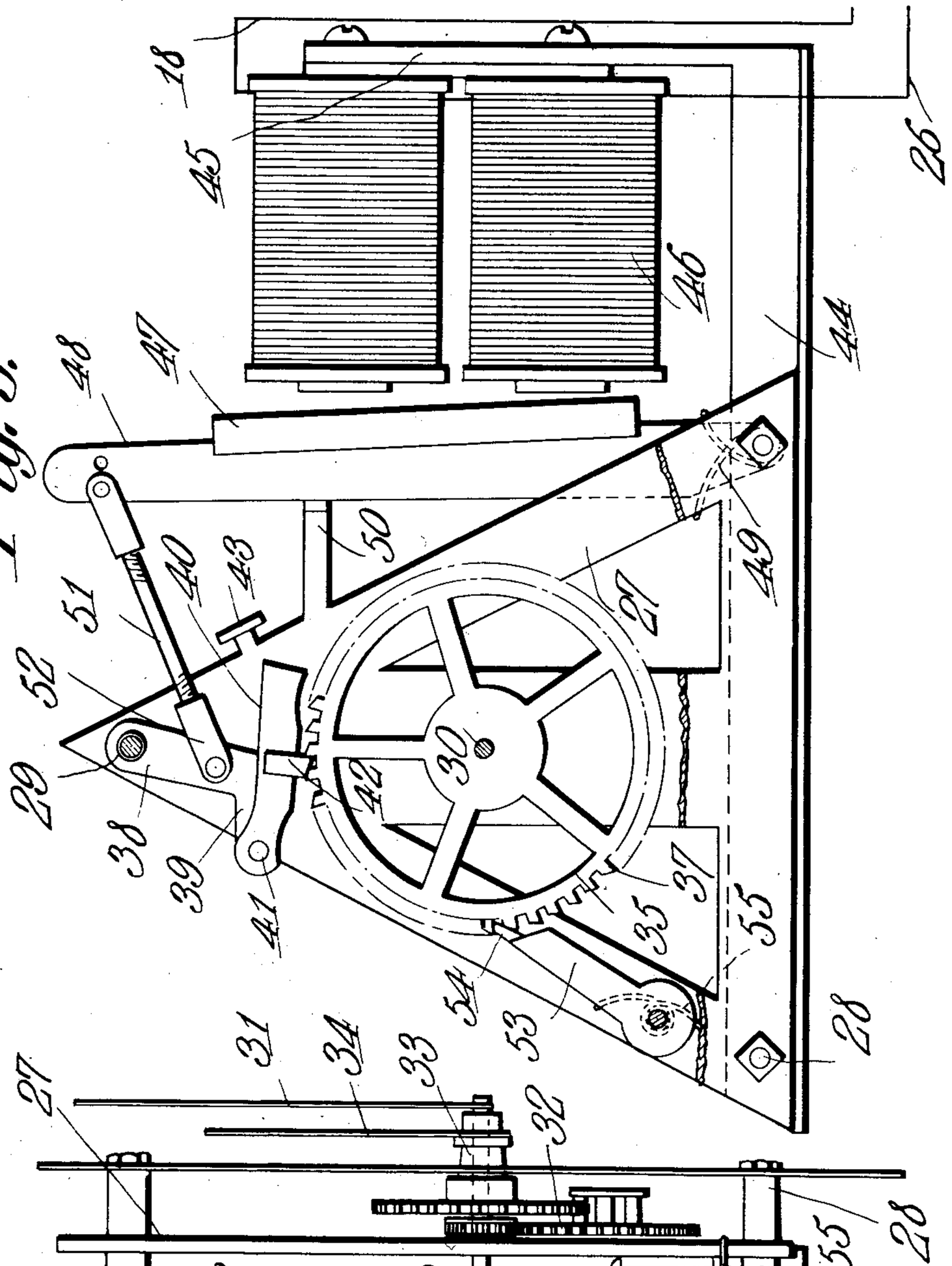

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 5.

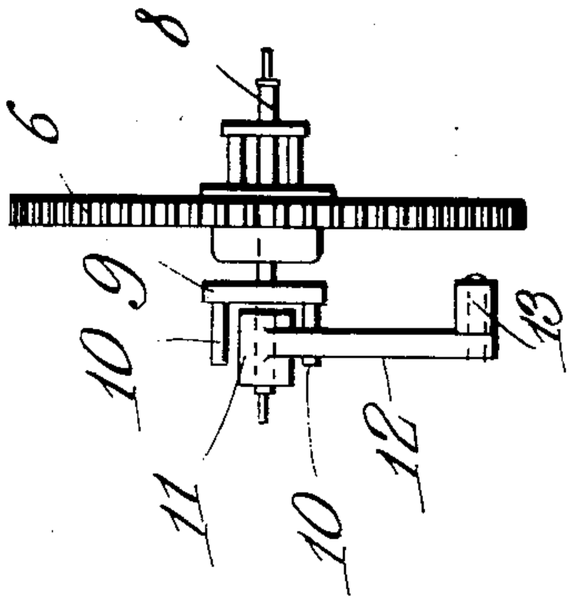


Fig. 6.

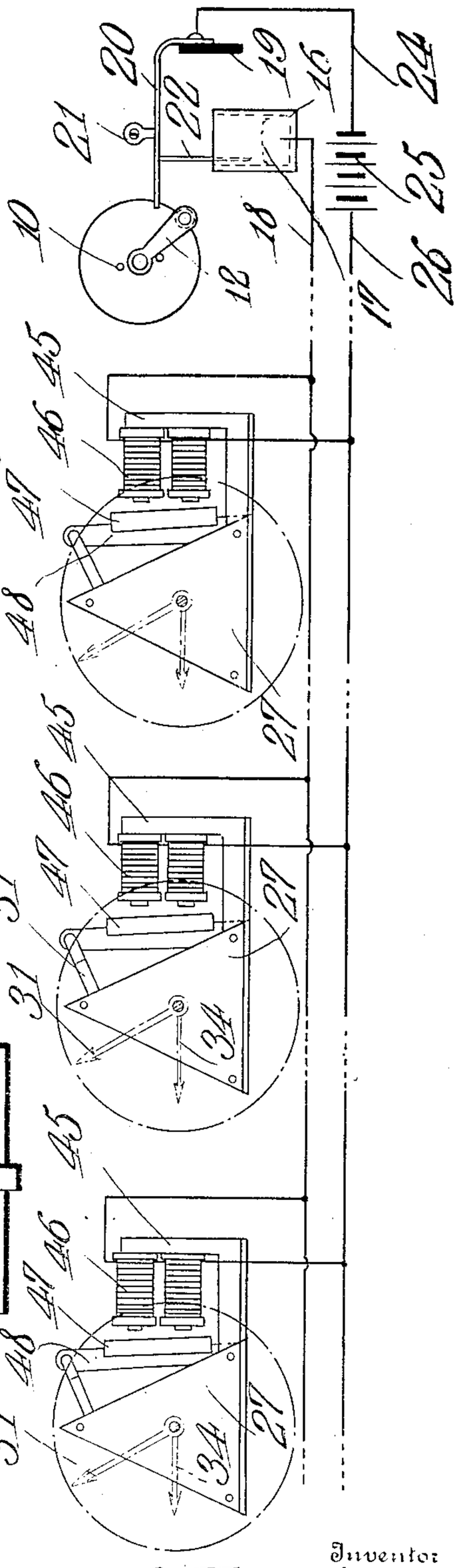
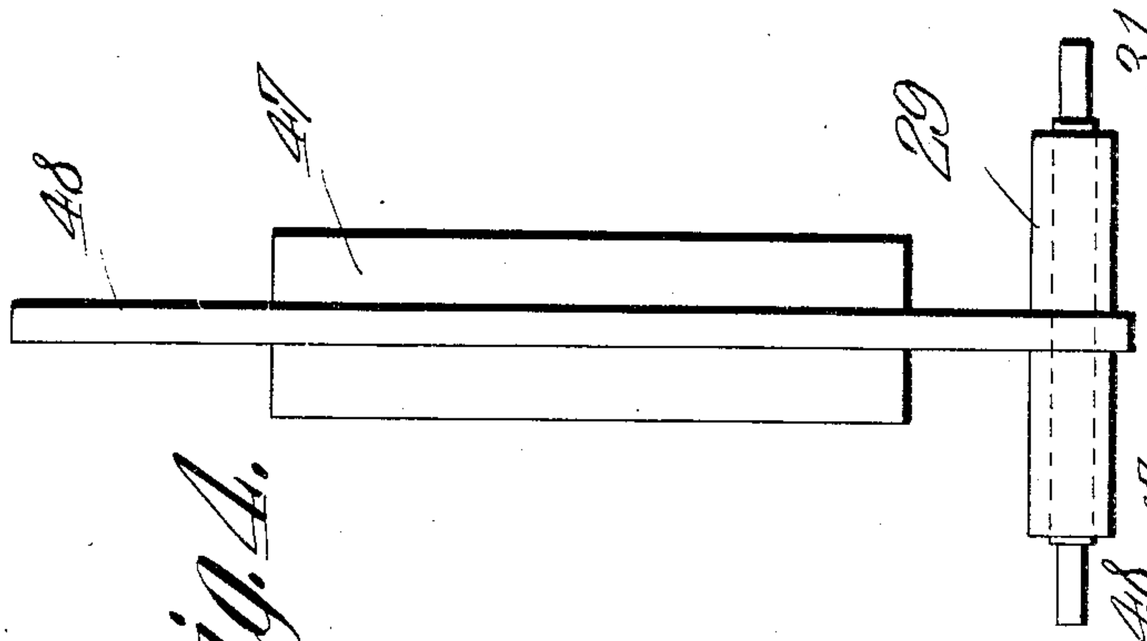


Fig. 4.



Witnesses

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UNITED STATES PATENT OFFICE.

HARRY OLIVER HARRISON, OF WICHITA, KANSAS, ASSIGNOR OF ONE-HALF TO SAMUEL McCREARY, OF WICHITA, KANSAS.

ELECTRIC CLOCK SYSTEM.

943,933. Specification of Letters Patent. **Patented Dec. 21, 1909.**

Application filed March 16, 1909. Serial No. 483,786.

To all whom it may concern:

Be it known that I, HARRY O. HARRISON, a citizen of the United States, residing at Wichita, in the county of Sedgwick and State of Kansas, have invented a new and useful Electric Clock System, of which the following is a specification.

This invention has reference to improvements in electric clock systems wherein a master clock causes the periodic sending to line of electrical impulses which in turn actuate the local clocks all at the same time and to the same extent.

It is the object of the present invention to provide a clock system of such character wherein the electrical impulses sent to line shall be of the shortest possible duration and shall be maintained upon the line only long enough to cause the actuation of the clocks, the duration of the impulses being very short as compared with the time period between said impulses.

In accordance with the present invention the master clock includes a clock movement of any capacity, whether one, eight, thirty, or more days continuous running at one winding or whether it be an electric clock movement or any other suitable clock movement which will answer the purposes of a master clock. The master clock has applied thereto an attachment whereby at stated intervals electric impulses are sent to line and are maintained for the shortest possible time to become effective at the local clocks so that the drain upon the current source is reduced to the minimum.

At the local stations the time indicating movements are of extremely simple character and are given impulses at stated time intervals by the electric impulses produced upon the line by the master clock. The time indicating hands at the local clocks are not continuously moving hands as in the ordinary clock movement but move step by step at predetermined intervals, say at intervals of one minute but otherwise synchronize in movement with the master clock so that the time kept by the master clock is reproduced simultaneously in all the local clocks which latter may be of any suitable number and as widely distributed as may be desired within the range of the effective action of the electrical source.

The invention will be best understood from a consideration of the following detail description taken in connection with the accompanying drawings, forming a part of this specification in which drawings,

Figure 1 is a structural diagram of the master clock and the means coacting therewith for sending momentary electrical impulses to line. Fig. 2 is an end elevation of one of the local clock movements. Fig. 3 is a side elevation of the same with parts broken away, and in section. Fig. 4 is a detail view of the armature and its mounting as found in a local clock. Fig. 5 is a detail view of a portion of the sending mechanism for producing the electrical impulses on the line, the view of Fig. 5 being at right angles to that of Fig. 1. Fig. 6 is a diagram showing illustratively the master clock and a number of local clocks controlled thereby.

Considering first the master clock as illustrated in Fig. 1 and also having some parts illustrated in Figs. 5 and 6, there is shown a suitable frame 1 in which is mounted a spring 2 which may be taken illustrative of any source of power capable of operating for any desired time period and may be capable of driving the master clock for one day, or eight days, or thirty days, or for a more extended period.

The power of the spring is transmitted by gear wheels 3, 4, 5, 6 to the escapement mechanism 7. Let it be assumed that the gear wheel 6 makes one complete rotation within a comparatively short time period say one in fifteen seconds, or one in thirty seconds, or even one in sixty seconds depending upon the general arrangement of the clock train. Upon the arbor 8 of this wheel 6 there is secured a disk 9 from which at diametrically opposite points there project pins 10 parallel with but spaced from the arbor 8 on opposite sides thereof, there being two such pins 10 in the structure shown in the drawings.

Mounted on the arbor 8 by means of a hub 11 free to turn on said arbor is an arm 12 projecting between and controlled by the pins 10 and this arm 12 carries at its free end a laterally projecting roller 13 for a purpose which will presently appear. Each time the arbor 8 is caused to move through one complete rotation one of the pins 10 will engage the arm 12 and lift the same from a pendent position to a position where the arm points toward the zenith and then when carried beyond this last named posi-

tion the arm becomes overbalanced and falls by gravity about the arbor 8 as an axis until it engages the other pin 10 and its movement is thereby arrested, the arm being slowly lowered to the pendent position by the progressive movement of the pin 10 which arrested the gravitating movement of said arm. It will be understood, of course, that the mounting of the pin disk 9 and arm 12 on the arbor 8 is to be taken as illustrative only, and when it is desirable that the movement of the arm 12 should take place at other intervals than would be the case when carried by the arbor 8, then the arm 12 and pin disk 9 are mounted on another arbor suitably geared, at the proper place, to the clock train. Of course the gearing of the local clocks, hereinafter described, will, in such case, be appropriately modified to act under the changed time periods of the actuating impulses.

Mounted on some fixed support such as the casing inclosing the master clock movement, which casing however is not shown in the drawings, there is a bracket 14 having at one end a post or standard 15. Mounted on the bracket 14 is a vessel or container 16 of iron or glass and this container holds a quantity of mercury indicated at 17. If the container be of iron a conductor 18 may be directly connected therewith, or if the container be of glass then the conductor 18 must be introduced into the container so as to be brought into electric contact with the mercury therein for a purpose which will presently appear.

Fast to the post 15 is an insulating strip 19 and secured to this insulating strip is a conducting strip 20 bent to horizontal position and preferably made of some spring material so as to be both elastic and electrically conducting. The free end of the strip 20 is carried to a position to be in the path of the roller on the arm 12 as it gravitates from the zenith position toward the pendent position and the relation between the strip 20 and the roller on the arm 12 is such that during this movement of the arm 12 from the zenith toward the pendent position, the strip 20 will be engaged by the roller 13 and the said strip will be bent downward and before the arm 12 is arrested by the lower pin 10 the strip 20 will escape from the engagement with the roller 13 and because of its elastic tendency will snap back toward the normal horizontal position, rebound beyond this position being prevented by a suitable stop 21 in the path of said strip.

The strip carries a finger 22 extending downward into the vessel 16 to a position where its free end is above the mercury but so related thereto that when the strip 20 is bent downward by the engagement of the roller 19 with its free end the end of the finger 22 will be caused to dip into the mercury and thus be brought into conducting relation to the latter and to the conductor 18 connected either directly to the mercury or with the cup or container 16. Since for electrical reasons it is not advisable to make the finger 22 of iron, the free end of the finger may be tipped with iron as indicated at 23 so as to be unaffected by the mercury, but the short iron extension will not offer sufficient electrical resistance to be considered.

The spring strip 20 is connected to one end of a conductor 24 leading to a battery 25 or other suitable source of electric current and from the battery there leads another conductor 26 which together with the conductor 18 may be carried to any distant point or points desired, these two conductors constituting the line conductors. Assuming that the master clock shown in Fig. 1 is continuously running and is keeping proper time, which may be indicated by suitable hands and dial not shown in the drawings, then at stated periods the arm 12 will be brought to the zenith position and will then be overbalanced and fall rapidly by gravity until the roller 13 engages the spring member 20 and bends the same sufficiently to cause the end 23 of the finger 22 to dip in the mercury 17, after which the roller 13 escapes from engagement with the spring strip 20 and is ultimately arrested by engagement with the pin 10 then constituting the lower pin.

When the finger 22 dips into the mercury 17 then there is established a circuit which may be traced as follows: Starting from the battery 25 the circuit is established through the conductor 24 to the strip 20, thence by way of the finger 22 and its terminal 23 to the mercury 17, thence by the conductor 18 to the distant point of utilization of the current and the circuit is completed through the conductor 26 back to the battery 25. This circuit is established every time the wheel 6 with its arbor 8 makes one rotation and while it may take a considerable time for this wheel to make one complete rotation, the circuit over the line wires is closed but a very small fraction of this time, the circuit remaining closed but a fraction of a second, while the impulses are given at time intervals of many seconds or even, in some cases at time intervals of a minute.

The local time pieces are best shown in Figs. 2 and 3. There is provided a suitable frame composed of end plates 27 joined at appropriate points by bolts 28 passing through spacing sleeves 29, or the bolts may be reduced at the ends where passing through the plates 27 as is customary in clock movements. The frame 27 carries an arbor 30 upon which is mounted the usual minute hand 31 and from this arbor is driven the

usual reducing gear 32 actuating the sleeve 33 on the arbor 30 carrying the hour hand 34, this being the customary arrangement in ordinary clock movements. On the arbor 30 between the plates 27 is secured a toothed wheel 35, and since the arbor will be used in the usual manner for setting the hands 31 and 34 by means of a suitable knob 36 the wheel 35 is frictionally mounted on the arbor 30 after the customary manner of mounting the driving wheel upon the hand arbor of a clock.

The teeth of the wheel 35 are indicated at 37 and it will be noted that these teeth are provided with terminal ends all slanting one way. This wheel 35 is the drive wheel for the arbor 30 and it is actuated by the electric impulses coming over the line wires 18 and 26 on the closures of the main circuit by the master clock.

Mounted on one of the sleeves 29 is a pendent arm 38 having an angle extension 39 carrying one end of a pawl 40 by means of a pivot 41. The pawl 40 carries a tooth 42 arranged to engage the teeth 37 to propel the wheel 35 in one direction while the tooth 42 will ride idly over these teeth when the pawl moves in the opposite direction. A stop member 43 is carried by one of the plates 27 in the path of the free end of the pawl 40 so that its movement in one direction beyond a certain predetermined limit may be prevented, but the arrangement of this stop plate is such that when the pawl is moved in the reverse or idle direction the rising of the pawl to permit the tooth 40 to pass over the teeth is not interfered with.

The base plate of the clock movement at the local station is indicated at 44 and this may be extended to one side and there be formed into or carry a post 45 to which is secured an electromagnet 46 of the horseshoe type by preference. Within operative relation to the polar ends of the magnet 46 is an armature 47 mounted on an armature lever 48 pivotally supported on one of the bolts 28, this lever being fast on one of the sleeves 29 so as to turn upon the bolt and at the same time space the plates 27 at this point. A spring 49 fast at one end to the clock movement frame and at the other end to the lever 48 tends constantly to move the armature 47 away from the magnet. A stop member 50 projecting from one frame member 27 is carried into the path of the armature lever to limit its movement away from the magnet so that the armature is always maintained within active relation of the polar ends of the magnet.

The free end of the armature lever 48 is connected to the pendent arm 38 by a link 51 and this link may have at each end oppositely threaded portions arranged to screw into threaded sockets on yokes 52 pivotally connected to the armature lever 48 and the arm 38 respectively. By this means the relative positions of the armature lever and the arm 38 with the pawl 40 carried thereby may be readily adjusted.

Pivoted to one of the frame members 27 is a back stop pawl 53 having a tooth 54 adapted to engage the teeth 37 of the wheel 35. This pawl 53 is maintained with its tooth 54 in normal engagement with the teeth 37 by a suitable spring 55.

When an impulse comes over the line then the magnets 46 are energized and attract the armature 47. This causes the arm 38 of each local time piece to swing about its pivotal support under the pull of the link 51 and the tooth 42 of the pawl 40 being in normal engagement with the teeth 37 engages one of the latter in a manner to cause a rotative movement of the wheel 35. On the forward movement of the wheel 35 the tooth 54 of the pawl 53 is inactive and simply rides idly over the teeth. The parts are normally so adjusted that the pull of the magnet upon the armature 47 will move the armature lever 48 a distance which will cause the swing of the arm 38 sufficiently to move the wheel 35 a distance of one tooth so that when the armature lever is returned to its normal position by the spring 49 after the magnet has become deënergized the tooth 42 will move back over a tooth and engage behind the next tooth in order to that which it first actively engaged and the tooth 54 of the pawl 53 will drop behind a tooth 37 to prevent a reverse movement of the wheel 35 on the return movement of the pawl 40 to its normal position on the deënergization of the magnet 46. Thus at each impulse sent over the line the wheel 35 is rotated a distance equal to the distance between two teeth and this ordinarily will agree to the distance between the minute indications on the clock dial so that ordinarily the minute hand will be advanced step by step at minute intervals and the hour hand of course will move correspondingly. If it be found advisable to move the clock hands at longer or shorter intervals than the minute intervals then the master clock will be constructed accordingly to send impulses at longer or shorter intervals as desired.

Let it be supposed that a system is installed with a master clock and as many local clock movements as may be desired. In this system the master clock controls and furnishes the power for actuating all the local clocks synchronously with the master clock. Assuming that the master clock runs correctly it follows that all the local clocks will indicate perfect time. As the arbor 8 of the master clock is rotated by the driving power of the master clock a pin 10 will engage the arm 12 and raise the same from the pendent position toward the zenith position and finally cause the overbalancing of

the arm when it will gravitate toward the pendent position until arrested by the other pin 10. During the fall of the arm 12 the roller 13 is brought into contact with the free end of the strip 20, and this strip being quite elastic will yield to the impact of the roller 13, bending down toward the cup 16. The proportion of the parts is such that the roller 13 will pass beyond the end of the strip 20 until the said arm 12 is stopped by the then lower pin 10 and the spring strip 20 will immediately move back to its normal position against the stop 21, the latter preventing any material vibration of the said strip 20. The downward movement of the strip 20 has caused the dipping of the end 23 of the finger 22 into the mercury 17. Of course it will be understood that mercury is not the only conducting medium that may be used but some conducting solution may be employed in place of the mercury, in which case the end 23 of the finger 22 will be composed of a suitable conducting material inert to any chemical action on the part of the solution. Because of the normally non-corrosive properties of platinum and its sufficient conductivity for the purpose the finger 22 may be made of such material if desired. The time period of immersion of the end 23 of the finger 22 in the conducting medium 17 is but a small fraction of a second, but this is sufficient to complete the electric circuit long enough to cause an impulse to traverse the several magnets 46 of the local clock movements and to cause the energization of these magnets and the attraction of their armatures 47 and the turning of the wheels 35 by such movements of the armatures. The electrical impulses cease almost instantly and consequently the drain on the battery 25 or other source of electric energy is reduced to a minimum. The parts may be so adjusted that there is practically no waste of electric energy and the battery is closed on the circuit only long enough and no longer than is necessary to cause the proper energization of the magnets 46.

It is evident that the local clocks may be connected up to the line circuits either in series or in multiple arc as may be found desirable. Furthermore, it is immaterial whether the sending of the impulses to line be in rapid or slow succession, for the time limit of each impulse will be the same.

What is claimed is:—

1. In an electric clock system, a master clock, an elastic switch arm, a contact member carried by the switch arm and adapted to close an electric circuit, a pivoted arm movable into direct engagement with the free end of the elastic switch arm and past the same by gravity, and means in the master clock for rotating the pivoted arm and periodically releasing the same to the action of gravity to cause the momentary active movement of the switch arm.

2. In an electric clock system, a master clock, an elastic switch arm having a normal tendency to the inactive position, a contact member carried by the switch arm, a mercury cup entered by said contact member in a normal position out of contact with the mercury, a pivoted gravity arm movable into direct engagement with the free end of the elastic switch arm and past the same by the action of gravity, and means in the master clock for rotating the pivoted arm and periodically releasing the same to the action of gravity to cause the momentary active movement of the switch arm.

3. In an electric clock system, a master clock, an electric circuit controlled thereby, and local clocks controlled by impulses sent over said electric circuit, each local clock comprising an electro-magnet, an armature lever actuated thereby, a ratchet wheel, a clock-hand carrying arbor actuated by said ratchet wheel, a pawl for moving said ratchet wheel actively, means for engaging said pawl and preventing the movement of the ratchet wheel beyond the point to which it was actuated by the pawl, a pivoted hanger carrying the pawl and adjustable connections between the armature lever and the hanger carrying the pawl.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

HARRY OLIVER HARRISON.

Witnesses:

WM. C. HERSHBERGER,

C. B. CLEAVELAND.