2 Sheets—Sheet 1.

M. HIPP.

ELECTRIC CLOCK.

No. 90,841. Patented June 1, 1869.

Fig. 1.

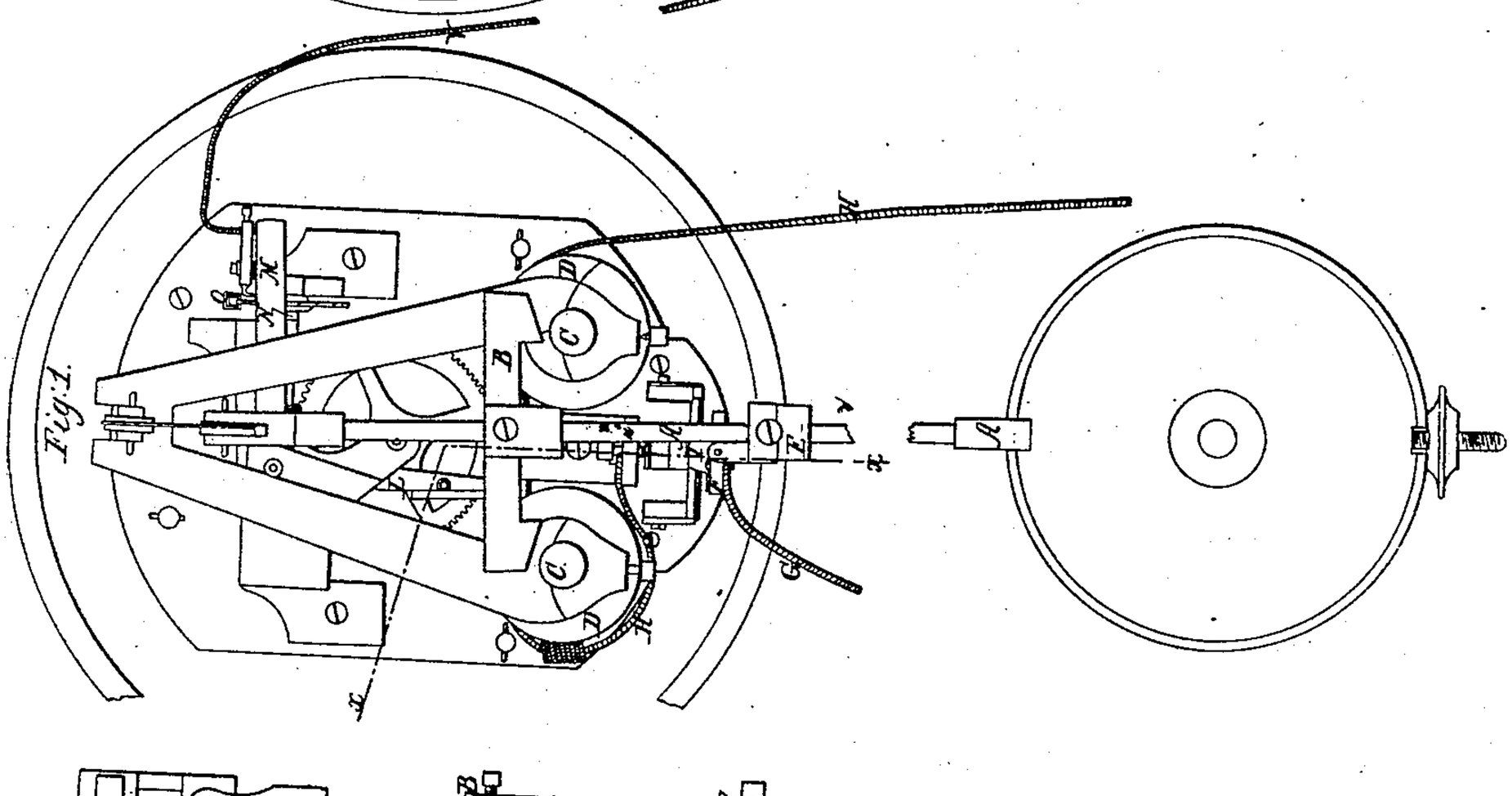


Fig. 2.

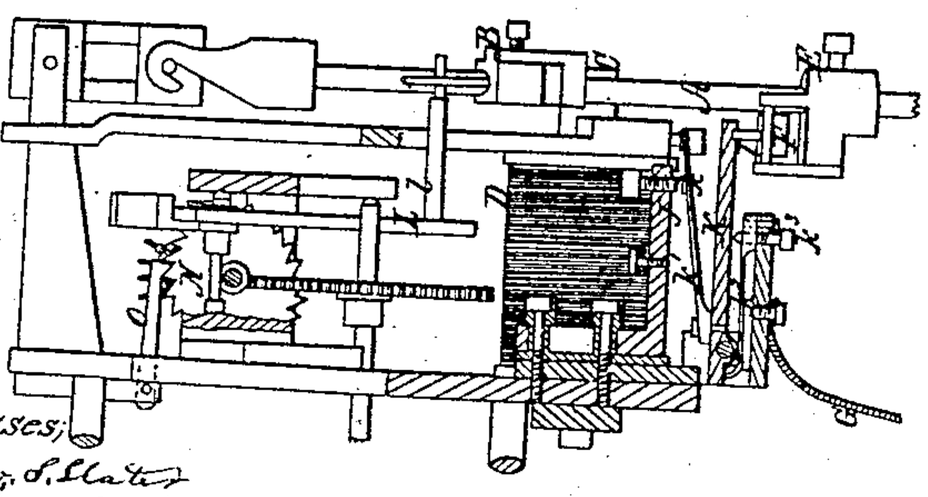


Fig. 3.

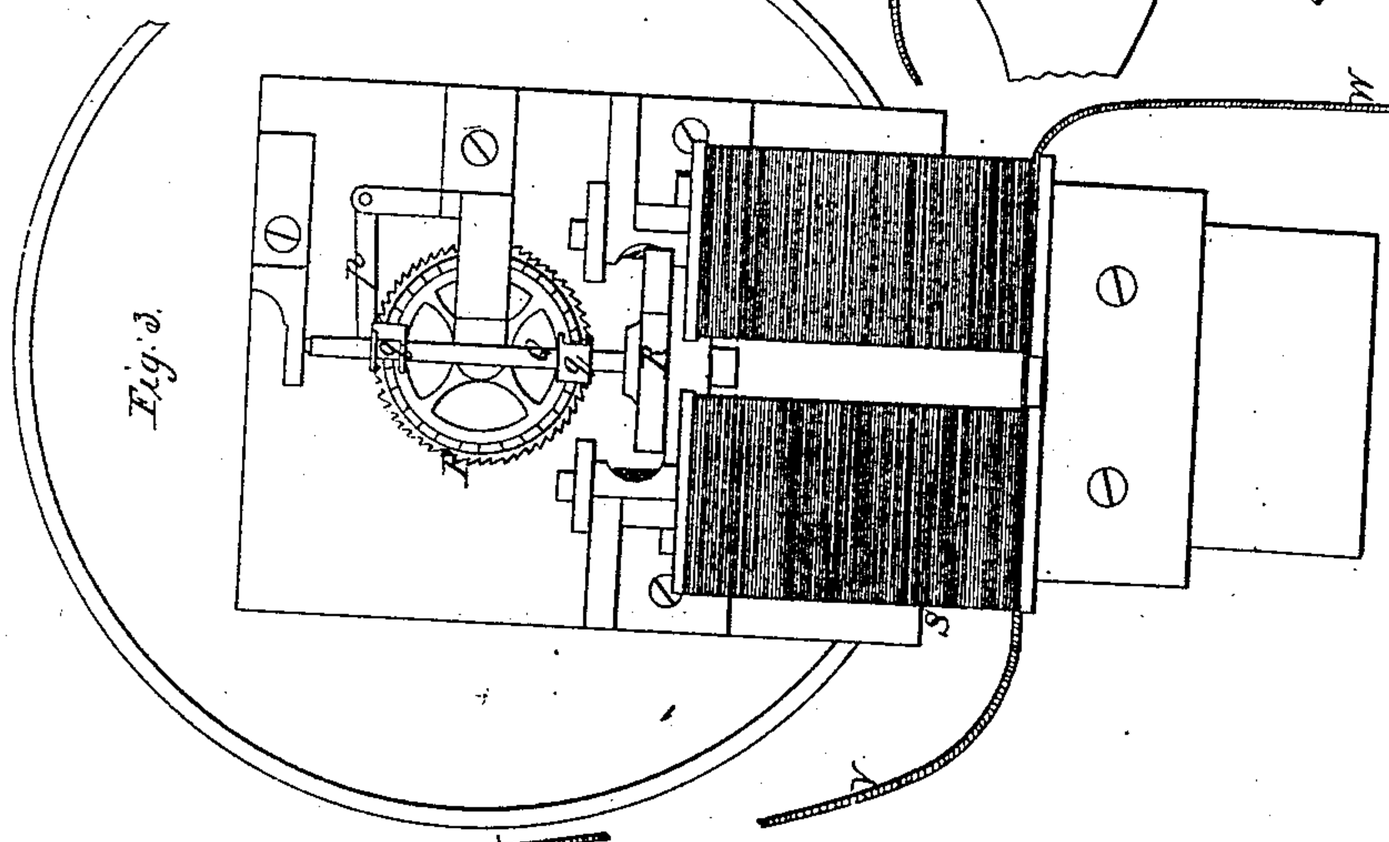


Fig. 4.

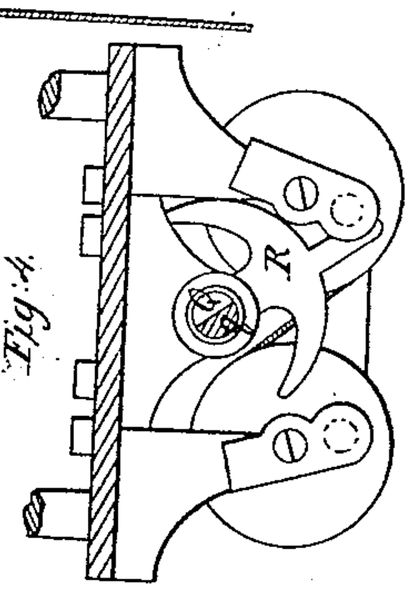


Fig. 5.

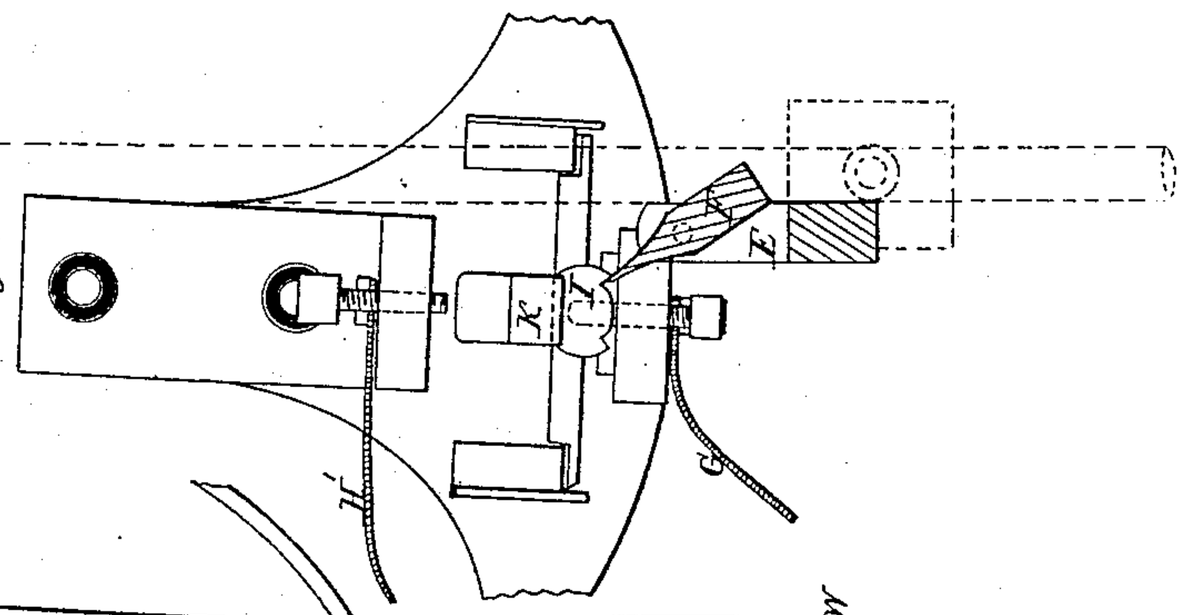


Fig. 6.

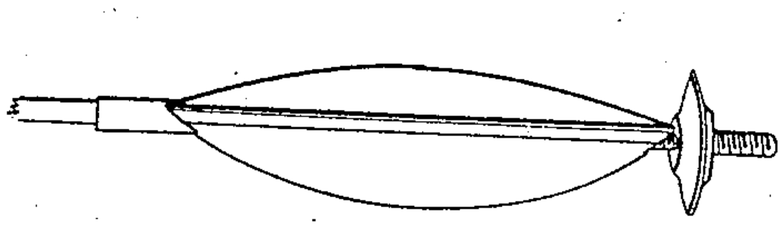
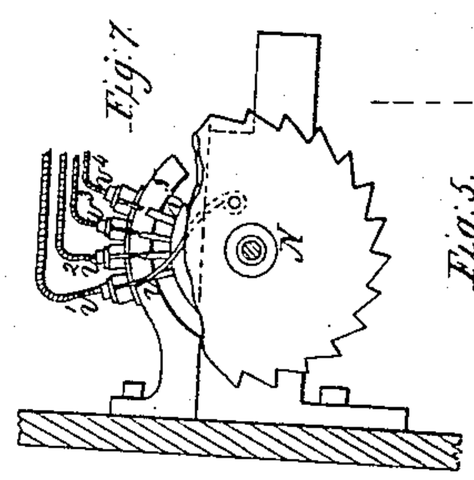


Fig. 7.



Witnesses;
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2 Sheets—Sheet 2.

M. HIPP.

ELECTRIC CLOCK.

No. 90,841. Patented June 1, 1869.

Fig. 8.

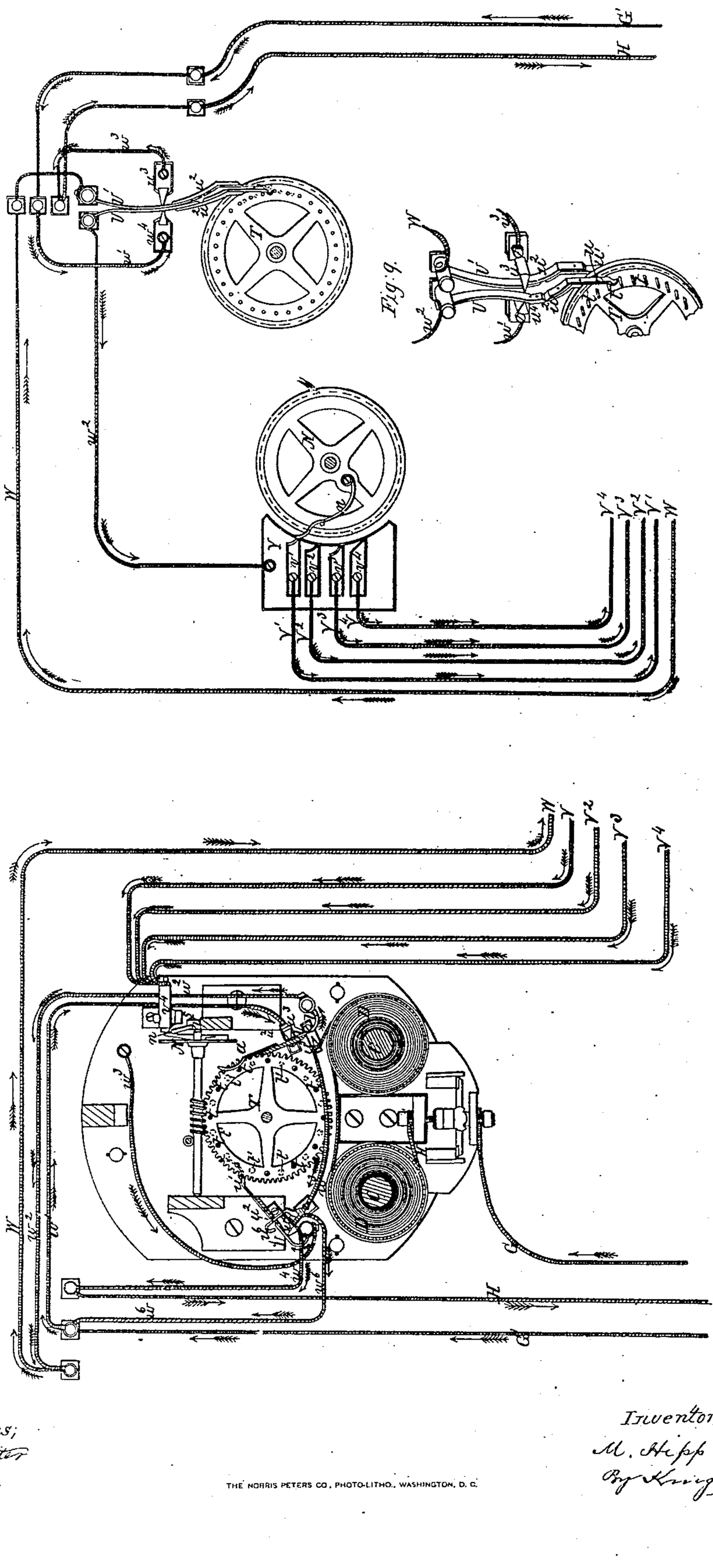

Fig. 9.

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United States Patent Office.

M. HIPP, OF NEUFCHATEL, SWITZERLAND.

Letters Patent No. 90,841, *dated June* 1, 1869.

IMPROVEMENT IN ELECTRIC CLOCKS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, M. HIPP, of Neufchatel, Switzerland, have invented certain new and useful Improvements in Electrical Clocks; and I declare that the following is a sufficiently full and exact description of the same to enable one skilled in the art to which the invention appertains, to carry it into effect, reference being had to the accompanying drawings, which are made a part of this specification.

My invention consists, first, in controlling the closing and breaking of the circuit of the electro-magnet which actuates the pendulum, by the action of the pendulum itself, in such a manner that the instant the stroke of the pendulum falls short of its proper length, a new impulse will be imparted to it by the electro-magnet, so as to maintain a practically uniform motion of the pendulum for an indefinite period of time, whether the power of the battery may be weak or strong.

My invention consists, secondly, in the employment of one or any number of detached dials, whose hands or pointers are operated by electro-magnetism, under the control of suitable clock-work, to break and close the circuit, and in mechanism by which reversed currents are communicated to the dial-magnets, in order to impart the necessary reciprocating motion to the armatures, to move the hands of the said dials.

My invention consists, thirdly, in a device for operating successive dials, or successive sections of a series of dials, by a common regulator, as hereinafter explained.

The term "dial," as used above, refers to a time-indicator, of simple construction, requiring no pendulum or balance-wheel, but which may consist of a face or dial proper, a pair or set of hands or pointers, an electro-magnet, a reciprocating armature, and any suitable mechanism to communicate the necessary rotary motion to the hands from the reciprocating movement of the armature. Any number of these detached "dials," located at any distance apart, may be controlled in their movement by a regulator common to all, the said regulator constituting a complete clock, whose pendulum controls both its own movement and that of the detached dials.

In the drawings—

Figure 1 is a rear elevation of the complete clock or regulator above referred to.

Figure 2 is a side elevation of the same, partly in section, on the line *x x*, fig. 1.

Figure 3 is a rear view of one of the detached dials.

Figure 4 is a plan or top view of the electro-magnet and armature of said dial.

Figure 5 is an elevation, on a larger scale, of the circuit-closing mechanism of the regulator.

Figure 6 is a vertical sectional view of the regulator, illustrating one mode of opening, closing, and reversing the dial-circuits.

Figure 7 is a detached sectional view of the circuit-closing mechanism on a larger scale.

Figure 8 is a diagram illustrating a modified and preferable form of mechanism for closing and reversing the circuits of the "dial"-magnets.

Figure 9 is a perspective view of the reversing-device.

Similar letters of reference indicate corresponding parts in the several views.

I will first describe the complete clock or regulator, and the mechanism by which the oscillation of its pendulum is maintained.

The pendulum A may be constructed and suspended in any common or usual manner, but, unlike the pendulum of a common clock, is provided with a cross-bar, B, constituting the armature of an electro-magnet, C D, and also carries a collar, E, which forms the bearing of a swinging pallet, F, employed to close the circuit of the electro-magnet C D.

G H may represent wires connected with the respective poles of a battery, which is employed to excite the electro-magnet C D at intervals, determined by the motion of the pendulum, there being no connection between the battery-wire G and the helix-wire H', so long as the motion of the pendulum extends beyond a certain length of stroke; but the instant the length of stroke is reduced, the point of the pallet F, catching under the notched plate I as the pendulum returns, raises the lever or key K to which the plate I is attached, so as to press the platina face *k* against the screw J.

The spring k^1, which forms a part of the key K, and carries the platina face *k*, yields sufficiently to prevent any considerable resistance to the motion of the pendulum, while insuring the closing of the circuit. The circuit being thus closed, and the electro-magnet excited, a new impulse is imparted to the pendulum at the beginning of its stroke.

As soon as the key K is released from the pallet F, it is retracted by a spring, k^2, and brought to rest on a set-screw, k^3, in customary manner.

It will be observed that the armature B never touches the cores C of the electro-magnet, but approaches them as the pendulum descends, and recedes from them as it rises in either direction, the closest proximity between the armature and the cores being when the pendulum is at mid-stroke.

So long as the pendulum swings far enough to carry the point of the pallet F beyond the notched plate I, the descent of the heavy lower end of said pallet causes the point or upper end to describe the arc indicated in red in fig. 5, so that on the return of the pendulum, the pallet will be carried under the notched plate I without raising the key K.

The pendulum may thus make any number of strokes without closing the circuit, until the effect of the last instantaneous impulse of the maguet is overcome; but

so soon as the pallet F fails to escape the notched plate, its point being caught by the latter, raises the key K, as the pendulum descends, so as to cause a new impulse to be imparted to the latter by the electro-magnet.

By these means, a practically uniform motion of the pendulum will be maintained, whether the battery be weak or strong.

The slightest shortening of the stroke automatically closes the circuit, so as to impart an instantaneous impulse to the pendulum, and the stronger the impulse, the greater will be the number of strokes before a further impulse is required.

The motion of the pendulum is communicated through an arm, *l*, to a lever, L, from which projects an arm, M, engaging with a ratchet-wheel, N.

The arm M is adapted to bend horizontally, so as to slip easily over the backs of the teeth of the wheel N as the arm rises, but to turn the wheel in its descent.

Every second stroke, or each double stroke of the pendulum, will thus turn the wheel N the distance of one tooth, and the motion may be communicated to the hands of the clock, through the medium of gearing, in any customary or suitable manner.

A pawl, O, prevents the retrograde movement of the wheel N.

The detached dials, and the mechanism for operating the hands thereof, may be described as follows:

P represents a wheel, taking the place of the escapement-wheel in ordinary clocks, but in this case deriving a positive motion from a reciprocating shaft, Q, provided with two semi-cylindrical tappets, *q q*, which engage, at diametrically-opposite points, with teeth on the face of wheel P, so as to turn said wheel in the same direction, and the distance of one tooth, at each motion of the shaft Q.

A pawl, *p*, prevents the backward movement of the wheel P.

The reciprocating movement of the shaft Q is imparted by a magnetic armature, R, attached thereto, and acted on by an electro-magnet, S S, cushions *r r* arresting the motion of the said armature, and preventing its contact with the cores of the electro-magnet.

To vibrate the armature R, the current is passed through the helices of the electro-magnet S, in opposite directions, alternately.

To change the direction of the current, various devices may be employed in the central clock or regulator.

In the illustration given in fig. 6, C D, C D represent the electro-magnet, G H H′, the conducting-wires, K, the circuit-closing key, and I, the notched plate attached thereto, as hereinbefore described.

T represents one of the gear-wheels of the clock-movement.

This wheel is provided, on each of its faces, near the periphery, with a series of pins, *t t′*, the pins *t′*, on the further side of the wheel, being arranged midway between the pins *t*, on the near side.

The function of these pins is to act alternately on the ends *u u* of springs U U′, by which the circuits of the dial-magnets are reversed, as hereinafter explained.

The ends *u u*, upon which the wheel T acts, are attached to the springs U U by plates u^1 u^1, of non-conducting material, so that there may be no electrical connection between the springs U U and the wheel T which operates them.

G′ may represent the positive, and H, the negative wire, communicating with the battery to operate the "dials."

V^1 V^2 V^3 V^4 are a series of wires, connected at one end to the respective pins or studs e^1 e^2 e^3 e^4, fig. 7, and at the other, to the electro-magnets of the respective "dials," or each wire may be made to serve for a connected series of dials.

W is a "return"-wire, serving, in common, for all the dials, being connected to the pole of each magnet S opposite to that to which the respective wires V^1 V^2 V^3 V^4 are connected.

The closing of the circuit is effected by a spring, *n*, attached to the wheel N, in such a position that as it passes each of the pins e^1 e^2 e^3 e^4, it will form an electrical connection between the said pin and one of the adjacent pins, e^5, which are in electrical connection with the wire w^3.

The blue arrows indicate the course of the electric current where its direction is always the same.

The red arrows show the course of the current while the reversing-gear is in the position represented in the drawing, but in places where its direction is reversed at each successive motion imparted to the "dials."

In fig. 6, the spring U is shown pressed out by the pin *t* of the wheel T, against the conducting-pin u^3, which is in electrical connection with the wire w^1.

At the same time, the end u^1 of the spring U′, having been released by the pin *t′*, has returned by its own resilience, and presses inward against the conducting-pin u^4, which is in electrical connection with the wire w^4.

Under these conditions, whenever the spring *n* closes the circuit, as before stated, the course of the electric current will be through the wires G′ w^1, pin u^3, spring U, and wires w^2, and W, to the "dial"-magnets; thence back through the respective wires V^1 V^2 V^3 V^4, the pins e^1 e^2 e^3 e^4, spring *n*, pins e^5, wire w^3, spring U′, pin u^4, and wires w^4 and H, to the battery.

The drawing, fig. 6, does not show the requisite number of pins *t* and *t′*, but sufficient for illustration.

In practice, the connections between the wheels N and T, and the number of pins in the latter, will be so proportioned as to change the positions of the springs U and U′ at each revolution of the wheel N.

Supposing the spring U *u* to be released from the pin *t*, so as to permit it to spring inward against the conducting-pin u^5, and away from the pin u^3, and the spring U′ u^1 to be pressed outward away from the pin u^4, and against the pin u^6, the course of the electric current will be as follows: through the wires G′ and w^6, the conducting-pin u^6, spring U′, wire w^3, pins e^5, spring *n*, pins e^1 e^2 e^3 e^4, and wires V^1 V^2 V^3 V^4, to the respective "dial"-batteries S, and thence back through the wires W and w^2, spring U, conducting-pin u^5, and wires w^5, w^4, and H.

It will be observed that the current is in this manner passed through the helices of the "dial"-magnets S in the opposite direction, so that the poles of the said electro-magnets will be changed, and a movement imparted to the armature R in an opposite direction from that which was caused by the current previously described.

A preferable form for the mechanism for closing and reversing the circuits of the "dial"-magnets is represented in the diagram, fig. 8, and the fragmentary perspective view, fig. 9. Here, as before, the blue arrows indicate the course of the current where it is never changed in direction, and the red arrows the parts where it is reversed at each stroke of the dial-armature.

In this, as in the other illustration of the invention, the springs U U′ are acted on by pins *t t′* on the opposite faces of the wheel T, but the said springs are placed so close together as to work between a single pair of conducting-pins; u^3 u^4.

The drawings, figs. 8 and 9, show the spring U resting inwardly against the conducting-pin u^4 and the spring U′, pressed outward against the pin u^3.

Under these conditions, as the spring *n* closes the circuit by forming an electrical connection between the insulated plate Y and the successive pins e^1 e^2 e^3 e^4,

the course of the current will be through the wires G′ and w^1, pin u^4, spring U, wire w^2, plate Y, pins v^1 v^2 v^3 v^4, and wires V^1 V^2 V^3 V^4, to the respective "dials" or sections of "dials;" thence back through the wire W, spring U′, pin u^3, and wires w^3 and H.

At the next revolution of the wheel N, the wheel T having moved the distance of one pin, the spring U will be pressed out against the pin u^3, while the spring U′ rests back against the pin u^4.

The current will then pass through the wires G′ w^1, pin u^4, spring U′, and wire W, to the "dial"-magnets; thence back through the respective wires V^1 V^2 V^3 V^4, spring n, plate Y, wire w^2, spring U, pin u^3, and wires w^3 and H, so as to reverse the poles of the electro-magnet S, fig. 3, and thus impart a reverse movement to the armature R, as hereinbefore described.

By dividing the entire number of "dials" into sections, controlled by the respective wires V^1 V^2 V^3 V^4, any number of which may be employed, extending completely around the wheel N, a very large number of "dials" may be actuated by a battery of comparatively small capacity, because the "dials" will be acted upon in succession, and not all at once.

The wheel T may be provided with sixty pins, thirty on each face, and be mounted on the shaft of the minute-hand, so as to perform a complete revolution in one hour.

The wheel N may turn simultaneously with the second-hand, once a minute acting on the "dials" or sections of "dials" in succession, each one or two seconds after the other; and, by a suitable proportionment of the connections P Q q q, fig. 3, moving the "dial"-hands one minute at each stroke.

The circuit-closing and reversing apparatus, shown in figs. 8 and 9, is more simple, and may be more compactly arranged, but I do not desire to limit myself to this arrangement.

The pallet F, or any equivalent device to effect the closing of the circuit, may be located near the upper end of the pendulum, as illustrated in figs. 1, 2, 5, and 6, or at the lower extremity, or at any intermediate part of its length.

The circuit-closing device, to communicate the motive-power to the clock, may also be applied to balance-wheels and other vibratory devices which are used as substitutes for pendulums.

My invention is very valuable in adapting the clocks to be worked equally well with either strong or weak batteries. Also, in adapting clocks to be worked with precision and uniformity by inconstant batteries. Also, in adapting an indefinite number of time-keepers of simple construction to be controlled with perfect uniformity by a regulator common to all.

The following is what I claim, and desire to secure by Letters Patent:

1. I claim the circuit-closing and reversing mechanism, adapted and employed to operate one or more detached "dials" under the control of a central regulator, substantially as described.

2. I further claim the series of circuit-closers v^1 v^2 v^3 v^4, arranged to actuate the "dials" or sections of "dials" in succession, substantially as described.

3. I further claim the pallet F, operating in combination with the notched plate I and key K, substantially as and for the purposes described.

4. I claim the combination of the spring k' with the key K, notched plate I, and pallet F, substantially as set forth.

To the above specification of my improvement in electric clocks, I have signed my hand, this 24th day of August, A. D. 1868.

M. HIPP.

Witnesses:

M. TRUSTMANN.

CH. MÜLLER.