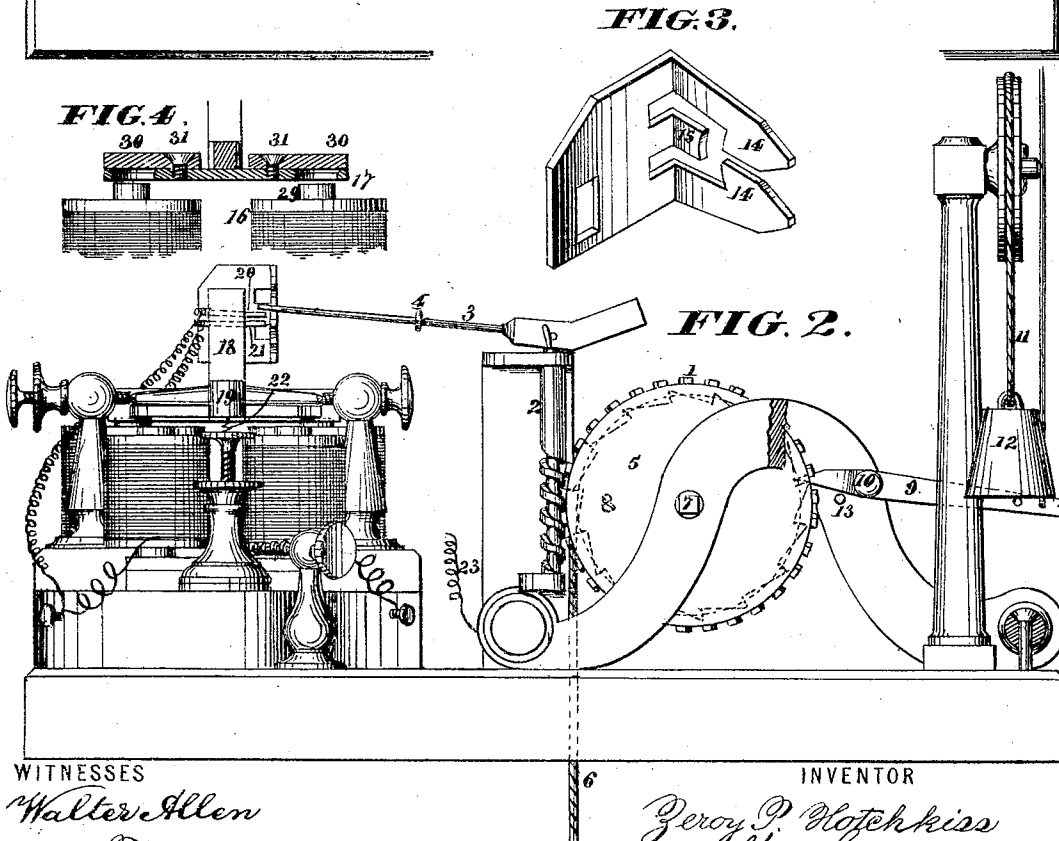
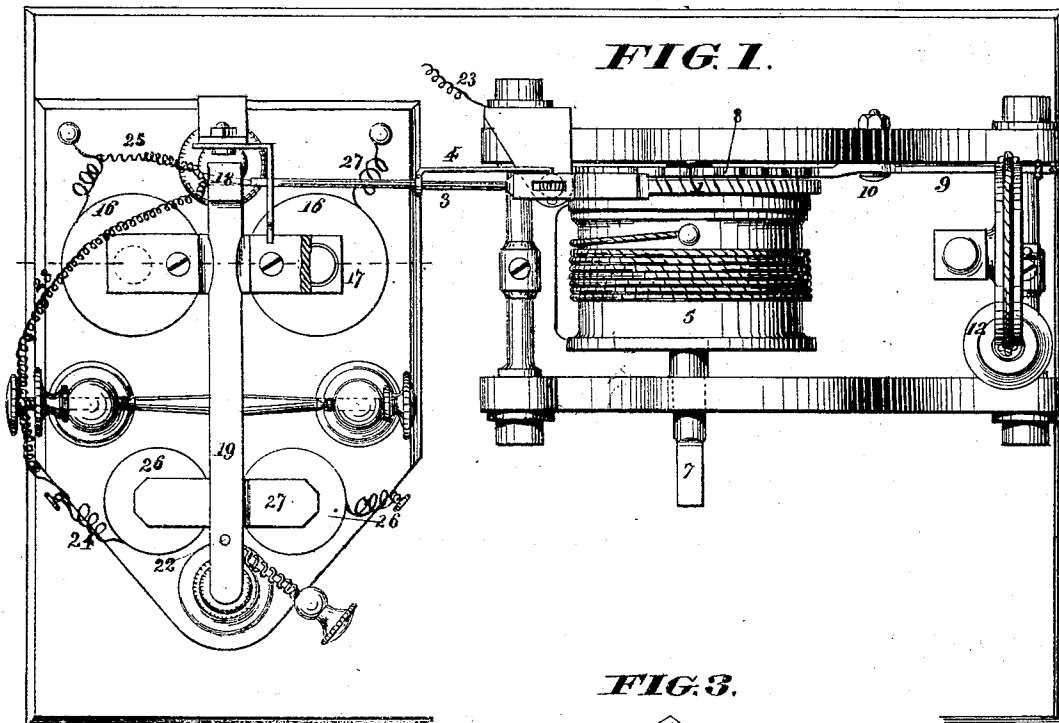


Z. P. HOTCHKISS.
Electric-Bell Striking Apparatus.

No. 157,003.

Patented Nov. 17, 1874.



WITNESSES

Walter Allen
Henry Fanner

INVENTOR

Zeroy P. Hotchkiss
 By *Knights* Attorneys

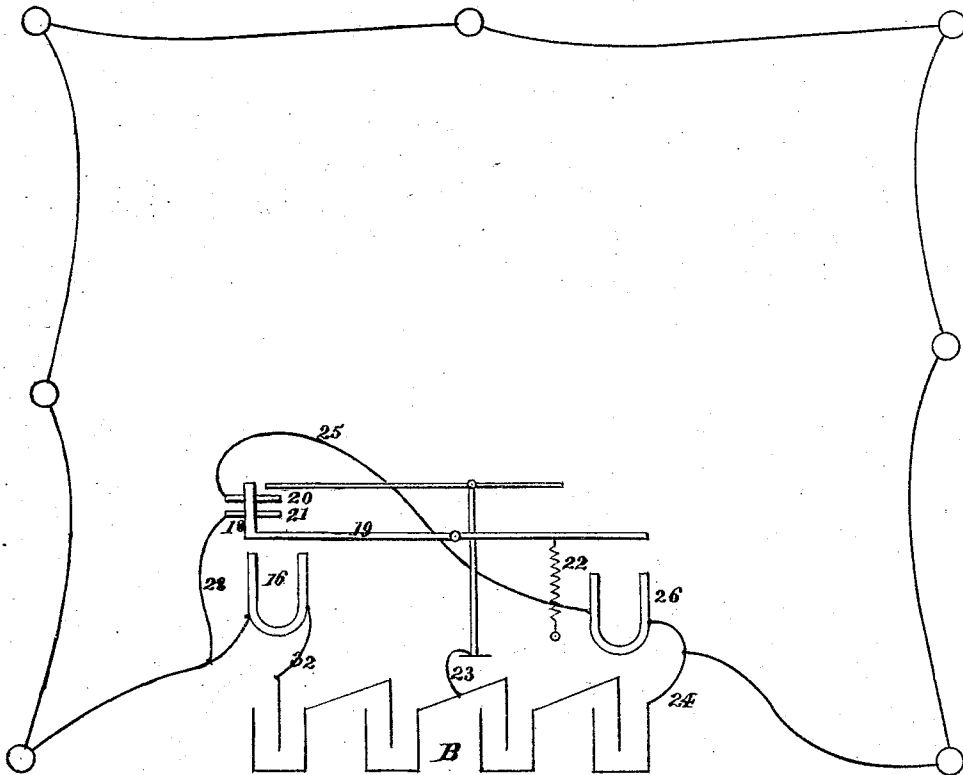
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FIG. 5.



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UNITED STATES PATENT OFFICE.

ZEROY P. HOTCHKISS, OF RICHMOND, INDIANA.

IMPROVEMENT IN ELECTRIC BELL-STRIKING APPARATUS.

Specification forming part of Letters Patent No. **157,003**, dated November 17, 1874; application filed August 17, 1874.

To all whom it may concern:

Be it known that I, ZEROY P. HOTCHKISS, of Richmond, in the county of Wayne and State of Indiana, have invented an Improved Electrical Bell-Striking Apparatus, of which the following is a specification:

My invention consists, first, in actuating or retracting a bell-hammer by means of a spring or weight, operated through a suitable lever by a revolving drum under control of a tripping mechanism, acting on the said drum through a spiral shaft and worm-wheel. The parts are so combined and arranged that two movements of the tripping mechanism and revolving drum are made to effect each retraction of the hammer, in order that it may be retracted to a greater extent without increased expenditure of power. The invention further consists in tripping the mechanism which controls the rotation of the drum by the action of an armature-lever, the movement of which is initiated by a spring on the breaking of the main circuit, and is completed by a local circuit closed by initial movement of the lever. The invention further consists in the employment of a revolving arm to form part of a local circuit, by which the said arm is tripped, and causing said arm to break the circuit when the tripping is effected. The invention further consists in the combination of an armature-lever, a spring, and two magnets, said magnets operating alternately on the two ends of the lever, in manner hereinafter described. The invention further consists in the combination of a magnet, an armature-lever, and a circuit breaking and closing mechanism, operating as hereinafter described, to cause the actuation of the said magnet by a local circuit, supplementing the effect of the main circuit. The invention further consists in the combination of a spring, a guide, a stop, and a pair of pins, the latter carried by the armature-lever, the whole operating as hereinafter described, to trip the revolving arm, which controls the movement of the drum, and to cause the said arm to be brought to rest at the same point after each stroke. The invention further consists in the construction of an armature with cavities to receive the ends of the magnet-cores, to cause an in-

creased movement of the said armature. The invention further consists in the combination, with the said recessed armature, of pivoted caps to increase its effect. The invention further consists in the combination of a stop with the lever employed to transmit the movement of the revolving drum to the hammer, as hereinafter described.

In the accompanying drawing, Figure 1 is a plan view of an apparatus illustrating my invention. Fig. 2 is a side elevation of the same. Fig. 3 is a detached perspective view of the guide and stop. Fig. 4 is a vertical section of the recessed and capped arm. Fig. 5 is a diagram illustrating the operation of the apparatus.

1 is a worm-wheel, gearing with a screw-shaft, 2, which carries at its upper end an arm, 3, pivoted to the top of said worm-shaft, so as to have a limited vertical play thereupon while controlling the rotation of the shaft 2. A spring, 4, tends to hold the arm 3 in its central position, and restore it to such position when deflected upward or downward. The worm-wheel 1 is attached to a drum, 5, which is revolved by a weighted cord, 6, and thus imparts a rotary motion to the arm 3 when the latter is free. The drum 5 is connected to the worm-wheel 1 through the medium of a ratchet, to permit the winding of the cord 6, which is performed by a common key applied to the square 7. The wheel 1 carries also a set of ratchet-teeth, 8, double the distance apart of the teeth of the worm-wheel 1, and acting upon a lever, 9, which is pivoted, at 10, to the main frame. The lever 9 is formed at its other or longer end with a number of apertures, to either of which a bell-cord, 11, may be applied.

In the drawings I have used a weight, 12, to illustrate the power employed to strike the hammer, the stroke of the hammer being given by a spring or weight in customary manner. In this description the elevation of the weight 12 will serve to illustrate the retraction of a bell-hammer of any construction.

After two revolutions of the spiral shaft 2 and arm 3, permitting the rotation of the wheel 1 to the distance of the two teeth, the lever 9 escapes from one of the ratchet-teeth 8,

permitting the hammer to fall. The lever 9 is then brought to rest against a stop, 13, placed in such position as to intercept its movement before its stroke falls upon the next of the ratchet-teeth 8, thus preventing any unnecessary jar. In practice, the wheel, drum, and screw are so proportioned that the weights upon the cords 6 and 11 can be almost equally balanced. I am thus enabled to employ any necessary weight without materially increasing the velocity with which the arm 3 will be revolved.

The second or final revolution of the arm 3, which releases the lever 9 and causes a stroke upon the bell, is caused by the breaking of the main circuit by means presently to be described. The first revolution of the said arm, causing the initial deflection of the lever 9 and the partial retraction of the hammer, is effected by the reclosing of the main circuit. At the termination of each revolution the arm 3 is received between the pair of guides 14, which direct it to the center of a stop, 15, upon which it rests until again tripped.

The magnet 16 is, in the normal condition of the apparatus, excited by the current in the main-line circuit, its armature 17 being consequently drawn down. An insulated standard, 18, projecting upward from the forward end of the armature-lever 19, carries a pair of pins, 20 21, which are in electrical connection with the two poles of the battery B. The armature 17 being held down, as stated, the upper pin 20 is kept from contact with the arm 3 until released by the breaking of the main circuit. The circuit being broken at any station on the main line, the back spring 22, raising the forward end of the armature-lever, throws the pin 20 into contact with the end of the arm 3, which forms a local circuit, by means of the wires 23 24 25, through a portion of the battery B, and a secondary magnet, 26, acting upon an armature, 27, on the rear end of the armature-lever 19. The effect of this is to complete the movement of the armature-lever initiated by the back spring 22 with sufficient force to trip the arm 3, throwing it upward off its stop, and permitting it to perform a revolution under the action of the wheel 1 and drum 5, until again arrested by the stop 15. This tripping of the arm, permitting it to escape from its stop 15, removes it also from contact with the pin 20, thereby instantly breaking the short circuit, and, leaving the armature-lever 19 free until the reclosure of the main circuit, drawing the forward end of the armature-lever 19, brings the lower pin 21 in contact with the end of the arm 3. This forms a new short circuit, by means of the wires 23 32 28, through a portion of the battery B and the primary magnet 16, supplementing the effect of the main line through the same magnet, and completing the downward stroke of the armature 17 with sufficient force to trip the arm 3 downward, permitting it to make another revolution. The escape of

the arm 3 from the pin 21 instantly breaks the local circuit 23 32 28, leaving the magnet 16 still in the closed main circuit, and causing it to hold the armature-lever 19 in its normal position, as originally described.

As already stated, this last-described motion, which is caused by the reclosure of the main line, imparts the initial movement to the lever 19 and begins the retraction of the hammer, the final retraction and release of the hammer being effected at the next revolution of the arm 3, which is caused by the breaking of the main line at any of the stations.

From the above description it will appear that my apparatus utilizes automatically any necessary portion of the main battery, operating through a local circuit to supplement or assist the effect of the main-line current and of the back spring, respectively, in imparting the alternate motions to the armature-lever with sufficient force to produce the mechanical effect required, to wit, the tripping of the arm 3, and, this action being performed, the motion of the arm itself automatically breaks such short circuits, leaving the armature-lever under the control of the main line.

In order to enable the main line current to attract the armature 17 with sufficient force, I have devised a novel construction of armature. This construction consists in recessing the armature, or forming therein cavities, in which the ends of the cores 29 may enter as the armature moves, thus placing a portion of the armature sufficiently near the core ends to initiate its movement, while adapting it to perform a long stroke. In order to complete the stroke of the armature I employ caps 30, covering the recesses, so that the magnetic effect may act directly downward upon the armature.

In applying my improved construction of armature to my present invention, the initial movement of the armature, which is produced by the attraction of its recessed portion, is effected by the current through the main line, while the supplemental or final movement, produced by the closing of the local circuit, acts through the caps 30 when the armature is partly depressed.

For convenience of construction I prefer to connect the caps 30 of the armature through the medium of pivot-screws 31, so that the caps may be turned off to permit the proper adjustment of the armature in relation to the cores, by which they are made to move as near together as practicable without actual contact.

The following is claimed as new:

1. The combination of the governing-arm 3, spiral shaft 2, drum 5, and the worm-wheel 1 with ratchet wheel or teeth 8, spaced at double the distance of the threads of the endless screw 2, so as to retract the bell-hammer in two revolutions of the said screw.

2. The combination of the armature-lever 19 and governing-arm 3 with a suitable bat-

tery, electro-magnet 16, and connections 20 21, to cause the tripping of the governing-arm by the continued movement of the lever under the influence of a local circuit, which is closed by the initial movement of said lever.

3. The combination of the governing-arm 3 with suitable mechanism for driving it, and a tripping mechanism causing it to break the electrical circuit by which it is tripped.

4. The combination of the armature-lever 19, the two magnets 16 26, the back spring 22, and electrical connections 20 21 23 24 25 32 with the battery B and main and local circuits, to effect an intermittent or alternate movement of the armature-lever, in manner substantially as set forth.

5. The combination of main and local circuits with a battery, B, armature-lever 19, and

magnet 16, to cause an initial movement of the said lever by the current in the main line, and a further movement in the same direction by a current in a local circuit closed by the said initial movement.

6. The combination of the spring 4, guides 14, stop 15, and pins 20 21 with the revolving arm 3 and armature-lever 19, operating to trip the said revolving arm and bring it to rest at the same point after each revolution.

7. The stop 13, in combination with the lever 9 and ratchet-wheel 8, for the purpose set forth.

ZEROY P. HOTCHKISS.

Witnesses:

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WALTER ALLEN.