

(No Model.)

J. WARING.
GALVANOMETER.

No. 422,672.

Patented Mar. 4, 1890.

Fig. 1

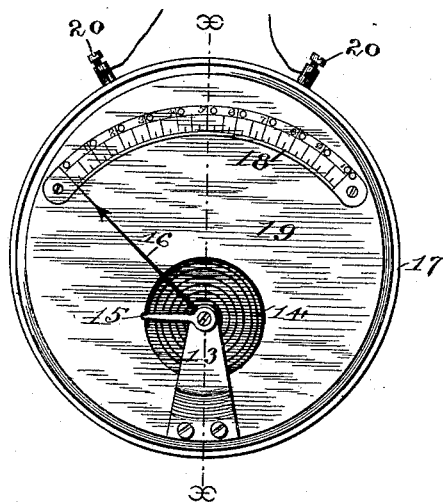


Fig. 2

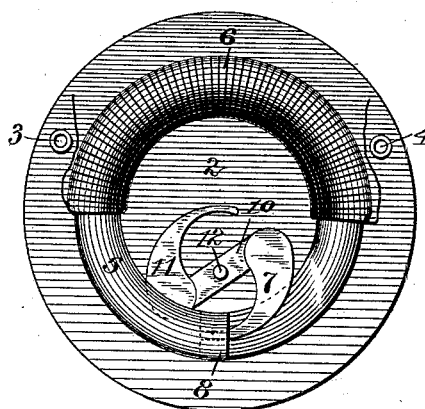


Fig. 3

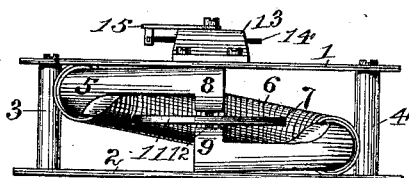
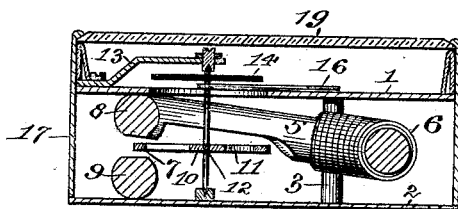


Fig. 4



Witnesses:

Harry R. Williams.
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UNITED STATES PATENT OFFICE.

JOHN WARING, OF MANCHESTER, CONNECTICUT.

GALVANOMETER.

SPECIFICATION forming part of Letters Patent No. 422,672, dated March 4, 1890.

Application filed October 21, 1889. Serial No. 327,636. (No model.)

To all whom it may concern:

Be it known that I, JOHN WARING, of Manchester, in Hartford county, Connecticut, have invented certain new and useful Improvements in Electric Indicators, which improvements are described in the following specification and are illustrated by the accompanying drawings.

My invention relates to that class of electric indicators in which an electro-magnet which forms part of an electric circuit acts upon its armature to produce those movements which indicate changes of current or electro-motive force.

The object of my invention is to obtain general excellence of operation in electric indicators of the described class, and in particular to render that operation strong and reliable in such indicators when made of small size. To accomplish this object I use an electro-magnet whose poles are near together and an armature which has a variable cross-section and is movable in the field across the lines of force.

The best method in which I have contemplated applying the principle of my invention is shown in the drawings, in which—

Figure 1 is a face or top view of an electric indicator which is constructed in accordance with my invention. Fig. 2 is a like view of the electro-magnet, armature, and base-plate of the same. Fig. 3 is an edge view of Fig. 1 without the external case. Fig. 4 is a section on line *xx* of Fig. 1.

In the views, the numerals 1 and 2 denote two circular plates, of brass or other non-magnetic material, which are fastened together in parallel positions by means of pillars 3 and 4, and constitute, respectively, the face-plate and base-plate of the instrument. In a fixed position between these plates is set an electro-magnet having a core of soft iron 5, which is wound in the usual manner with insulated wire, constituting the helix 6. Core 5 has the general form of a ring or spiral. The poles or pole-pieces 8 and 9 at its opposite ends are placed one above the other at a distance apart which is slightly greater than the thickness of the armature 7, hereinafter described, and the terminal portions of core 5, between the pole-pieces and helix 6, are bent or cut away from the path of the armature.

The latter is a thin curved plate of soft iron, which is quite small or pointed at one end. A cross-section of the armature, taken at any distance from its point, is greater than a cross-section taken at any less distance therefrom. Armature 7 and a brass counterpoise 11 of equal weight and similar form are attached to the opposite ends of an arm or bar 10, which is made of brass or other non-magnetic material and is fastened upon a central vertical spindle 12. This spindle passes through a hole in plate 1, and has terminal bearings, one upon plate 2 and one in a bearing-plate 13, which is fastened to the top of plate 1. By means of the spindle and bearings just mentioned, the connected armature and counterpoise 7 and 11 are pivoted within the circuit of core 5 in such a position that said armature may move lengthwise and horizontally through the space between poles 8 and 9. A hair-spring 14 is attached by one end to spindle 12 and by the other end to an arm 15, extending from plate 13. A pointer 16, attached to spindle 12, traverses a graduated plate 18, which is secured to plate 1. The described mechanism is inserted in a cylindrical wooden case 17, having a glass cover 19 and two binding-posts 20, which are respectively connected with the two ends of helix 6. Other particulars of construction will sufficiently appear from the drawings and from the mode of operation.

The general mode of operation of my invention is too obvious to require description. It may, however, be observed that as the magnet is energized the armature has a motion of translation in and through the field and across the lines of force, and that the extent of that motion is determined by the extent of the changes which may occur in the energy of the magnet.

Such being the construction and operation of my invention, I claim—

1. In an electric indicator, an electro-magnet having a spiral core with terminal poles, in combination with a curved and tapering armature which is mounted upon a counter-balanced non-magnetic arm and is adapted to move in the direction of its curvature through the narrow space between said poles, substantially as and for the purpose specified.

2. In an electric indicator, an electro-mag-

net of spiral form, and a flat, curved, and tapering armature which is mounted upon a non-magnetic arm, is provided with a non-magnetic counterpoise, and is adapted to
5 move lengthwise through the narrow space between the poles of said electro-magnet, in combination with a pointer which is actuated by said armature, substantially as and for the purpose specified.

10 3. In an electric indicator, an electro-magnet having a spiral core with terminal poles, and a curved and tapering armature which is mounted and counterbalanced upon a non-magnetic pivoted arm and is adapted to move
15 lengthwise through the narrow space between said poles, in combination with a retractile spring and a pointer, substantially as and for the purpose specified.

4. In an electric indicator, an electro-magnet having a circular core and terminal poles 20 which are one above the other, and a flat and tapering armature which is counterbalanced and mounted upon a non-magnetic pivoted arm and is adapted to swing horizontally between said poles, in combination with a re- 25 tractile spring, a pointer, and a graduated scale, substantially as and for the purpose specified.

In testimony whereof I hereunto set my name in the presence of two witnesses.

JOHN WARING.

Witnesses:

WILLARD EDDY,
RICHARD H. MATHER.