(No Model.)

A. H. HOYT.

GALVANOMETER.

No. 500,264. Patented June 27, 1893.

Fig. 1.

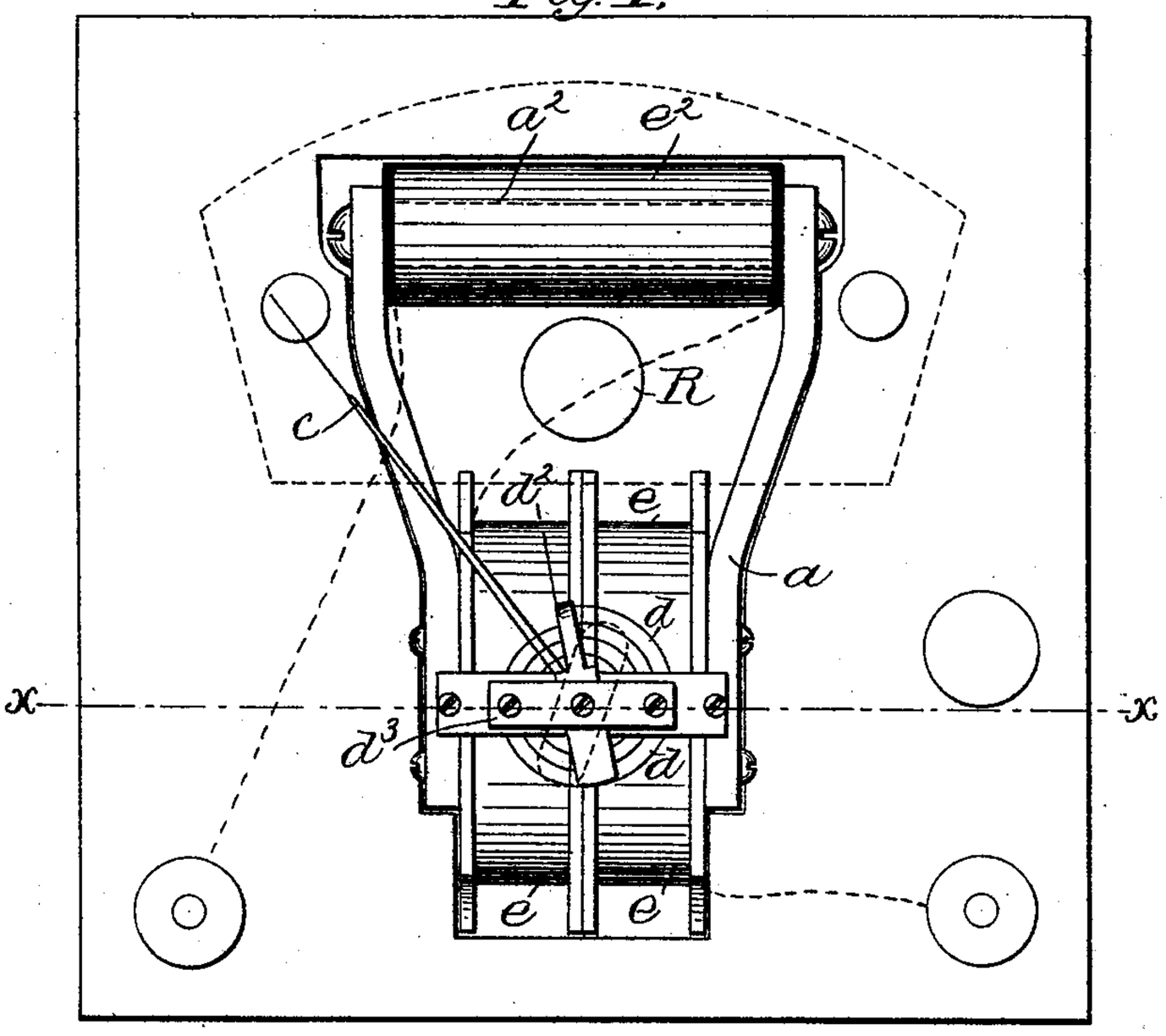


Fig. 2.

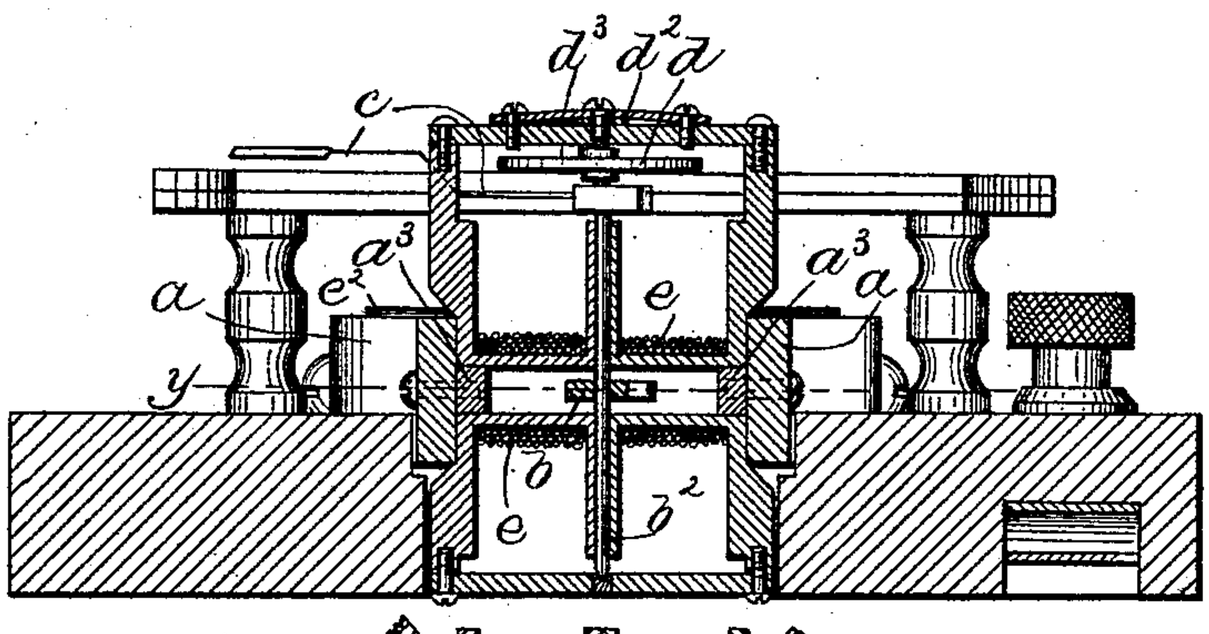
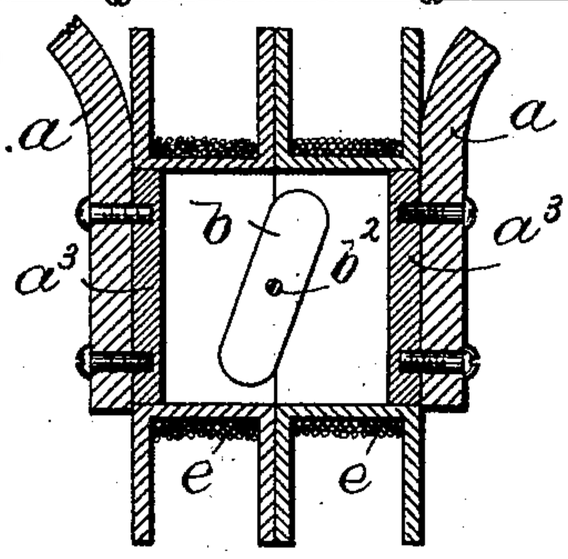


Fig. 3.



Witnesses
Jas. J. Maloney.
M. E. Hill

Inventor.
Adrian H. Hoyt.
by Jos. P. Livermore
Atty.

UNITED STATES PATENT OFFICE.

ADRIAN H. HOYT, OF MANCHESTER, NEW HAMPSHIRE, ASSIGNOR TO THE WHITNEY ELECTRICAL INSTRUMENT COMPANY, OF SACO, MAINE.

GALVANOMETER.

SPECIFICATION forming part of Letters Patent No. 500,264, dated June 27, 1893.

Application filed September 5, 1892. Serial No. 445,113. (No model.)

To all whom it may concern:

Be it known that I, ADRIAN H. HOYT, of Manchester, county of Hillsborough, State of New Hampshire, have invented an Improvement in Galvanometers, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relates to a galvanometer or electric instrument especially intended for indicating alternating currents.

The invention is embodied in an instrument having a neutral or soft iron field magnet and a neutral or soft iron needle or armature, and coils for the current to be measured arranged with relation to said magnet and armature to cause both to be magnetized simultaneously the parts being so constructed and arranged as hereinafter described, that the magnetizing effect of the current is substantially simultaneous in the magnet and armature so that both respond simultaneously to the reversals in an alternating current, thus retaining the polar relation of the magnet and the armature constant so that the movement of the said armature due to magnet attraction in opposition to a determinate resistance or retractor is variable in accordance with the strength of the current employed so that the amount of said movement may be used to indicate the strength of the current. To accomplish this result the branches of the magnet, which is of the horseshoe type, are provided with pole pieces between which the armature or needle is supported upon a pivot having its axis at right angles to the line joining the centers of the pole pieces, and the coil is wound to surround the said pole pieces and the space between them in which the armature turns, so as to completely inclose the armature and adjacent portion of the pole pieces, the said coil being in the form of a flattened tube the axis of which coincides with the line joining the middle of the pole pieces. A magnet of this kind is retarded in response to a change in current more than the armature and in order to accelerate the response of the magnet to the changes in the current so as to make the said magnet respond substantially simultaneously with the armature a portion of the body of the magnet, shown in this instance as the back strap or bridge joining the branches of the magnet, is also provided with a coil, connected in circuit with the coil around the poles and armature and co-operating with the coil around the poles to reverse the polarity of the magnet when the current reverses; the effect of the two coils upon the magnet causing it to respond simultaneously with the armature acting under the influence of the coil between the poles of the magnet.

Figure 1 is a plan view of an indicating instrument embodying this invention, the inclosing case and dial or graduated scale being removed to show the working parts of the instrument. Fig. 2 is a vertical section on line x, x, Fig. 1, and Fig. 3 a sectional plan at line y, Fig. 2.

The instrument comprises a neutral or soft iron field magnet a shown in this instance as composed of two arms or branches connected together near one end by an iron bar or back strap a^2 and provided at their unconnected or polar ends with pole pieces a^3 best shown in Figs. 2 and 3, the said pole pieces being rectangular bars of less width than the ends of the branches of the magnet and of considerable extent along the ends of the said branches and extending a short distance laterally from the sides of the magnet branches and toward one another. Between the said pole pieces is the needle or armature b which is also neutral or of soft iron and is supported upon a pivot or arbor b^2 working in suitable bearings and being provided with the indicating pointer c and acted upon by a spring d which tends to resist the rotary movement of the armature produced by the magnetic attraction between it and the pole pieces a^3. The inner end of the said spring d is connected with the arbor b^2 while its outer end is connected with an arm d^2 adjustably held by a clamp piece d^3 upon the frame work so that it may be set to give a greater or less initial strain on the spring as may be required.

As neither the field magnet nor the needle b are permanently magnetized there is normally no appreciable magnetic attraction exerted between them, and the parts are normally set with the armature in about the position shown in Fig. 3, that is, slightly in-

clined to the adjacent faces of the pole pieces a^3, and nearly at right angles to the line joining their middle points, the spring d at this time being under minimum tension and the pointer c being set at the zero position or indicating that no current is passing through the instrument.

If both the magnet and the armature b should be energized properly to give the poles a^3 opposite polarity each to that of the nearer end, or pole of the armature, the usual magnetic forces of attraction and repulsion will tend to turn the armature to a position in line with the line joining the middle of the poles a^3 and such movement of the armature will be resisted by the spring d, with a constantly increasing force so that the amount of movement produced and indicated by the pointer may be used as an indication of the amount of magnetic force with which the magnet and armature are energized, and it is furthermore obvious that it is immaterial what the actual polarity of the magnet and armature may be so long as the relative polarity remains the same, *i. e.* so long as each pole a^3 is of opposite polarity to that of the nearer polar end of the armature b and consequently if the polarity in both the magnet and armature be reversed simultaneously and both respond equally quickly to said reversal no change in position will be produced by such reversal.

The magnetic field and the armature are energized by current passing through the coil e preferably wound in the form of a flat tube and wholly surrounding the needle b and also at its ends surrounding the poles a^3 so that the effect of the current passing through the coil e is to simultaneously energize the field magnet and the armature, that is to polarize both, and to make the poles a^3 opposite in character to the nearer poles of the armature d whichever way the current may pass through the said coil and if the current be rapidly reversed, *i. e.* an alternating current, both the poles a^3 and the poles of the armature b will also be reversed and will always remain in the same relation to one another, *i. e.* each pole a^3 of unlike polarity to the nearer pole of the armature b so that the movement of the armature about its axis will be proportional to the strength of the current. With the magnet and armature constructed as shown, the magnet will be retarded in its response to the current in the coil e by self induction, while the armature will not be so retarded, and this fact would interfere with the proper indications of the needle for an alternating current. In order to overcome this difficulty, and to render the magnet as quick to respond to a reversal in polarity of the current as the armature, the magnet is acted upon by an auxiliary coil e^2 shown in this instance as wound upon its back strap a^2 and connected in circuit with the coil e so that the magnet is affected by the current in both coils e, e^2, while the armature is affected only by the same current in the coil e the result being that by properly proportioning the coils as can be readily determined by experiment the magnet can be made to respond to the current simultaneously with the armature b and consequently the relative polarity of the armature and field will remain constant although both are energized by an alternating current, and are consequently having their actual polarity subject to rapid reversals. The instrument may be provided with a resistance coil R to receive a portion of the current from the external circuit containing the current to be measured in the usual manner.

By having the adjacent faces of the poles a^3 substantially parallel to one another rather than concentric with the curve in which the ends of the armature move, the attractive force exerted between the magnet and armature increases as the armature approaches the position in line across the poles which is desirable in an instrument of this kind and makes the amount of movement of the armature and indicating pointer connected therewith nearly directly proportional to the strength of the current.

I claim—

1. An electric indicating instrument comprising a neutral or normally non-magnetized field magnet, and a neutral armature or needle, combined with the coil for the current to be measured, interposed between the poles of said magnet and surrounding the said needle, whereby the needle and magnet are simultaneously energized, and their relative polarity remains the same when energized by an alternating current in the said coil, substantially as and for the purpose described.

2. The combination of the neutral or normally non-magnetic field magnet provided with substantially rectangular pole pieces a^3 with the armature pivoted on an axis between the said pole pieces and the coil e surrounding the said armature and having its end around the said pole pieces, substantially as and for the purpose described.

3. An electric indicating instrument comprising a neutral or normally non-magnetized field magnet and a neutral armature or needle, a coil around the said armature between the poles of the magnet and an auxiliary coil in the same circuit with the said coil surrounding a portion of the body of the said magnet, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ADRIAN H. HOYT.

Witnesses:
JOS. P. LIVERMORE,
M. E. HILL.