(No Model.)

J. O. HEINZE, Jr.

VOLT AND AMPERE METER.

No. 496,309. Patented Apr. 25, 1893.

Fig. 2.

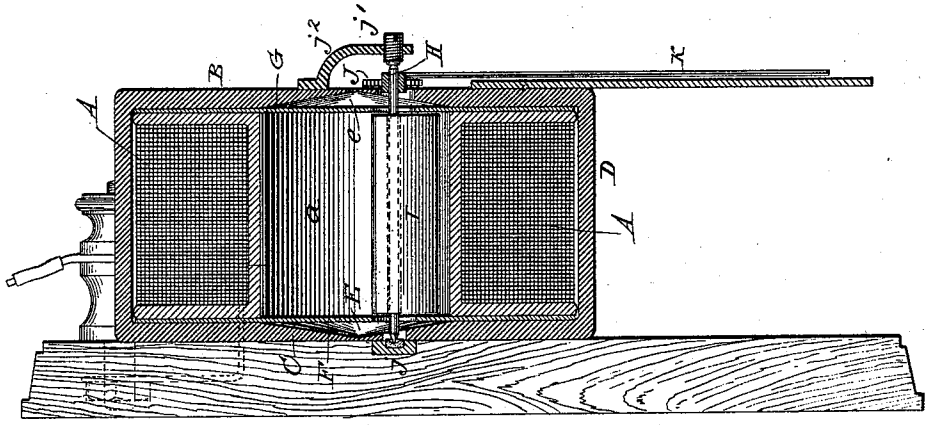
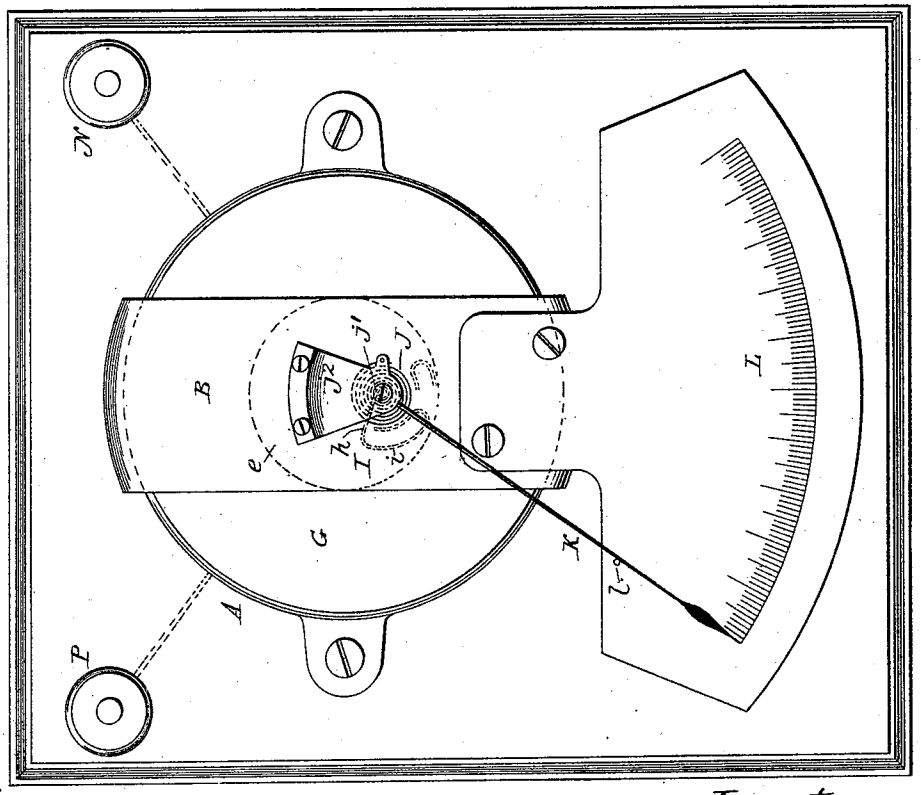


Fig. 1.



Witnesses,
Sidney P. Hollingsworth
A. S. McClain.

Inventor,
John O. Heinze Jr.
by his attorney,
Stephen Jarvis

UNITED STATES PATENT OFFICE.

JOHN O. HEINZE, JR., OF LYNN, MASSACHUSETTS, ASSIGNOR TO THE HEINZE ELECTRIC COMPANY, OF SAME PLACE.

VOLT AND AMPÈRE METER.

SPECIFICATION forming part of Letters Patent No. 496,309, dated April 25, 1893.

Application filed October 17, 1892. Serial No. 449,130. (No model.)

To all whom it may concern:

Be it known that I, JOHN O. HEINZE, Jr., a citizen of the United States, residing at Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Volt and Ampère Meters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in machines for measuring the strength or intensity of an electric current, which are known as volt meters, and ampère meters. The construction and mode of operation is the same in principle whether the instrument is to be a volt or an ampère meter, the difference being in the relative proportions and resistances of the parts and the mode of connection to the circuit to be measured. This will be understood by those skilled in the art and I will therefore describe and refer to the instrument as a voltmeter.

The construction and general arrangement of my improved instrument will be set forth in the following description, and referred to in the appended claims.

In the accompanying drawings:—Figure 1.—is a view in elevation, the part of the front of the electrical device removed for better illustration. Fig. 2— is a vertical sectional elevation of a voltmeter embodying my invention.

Referring to said drawings, A is a solenoid of insulated wire outside of which is placed an encircling band B C of iron which is magnetized by the solenoid A, to a greater or less extent according to the current to be measured. Beginning at the circumference of the space within the solenoid which I call the chamber *a*, the band B C decreases in thickness toward the axis thereof, forming a concave in said band at each end of the chamber. The margins of these concaves in the band B C are closer to the armature I, and therefore have a greater magnetic pull upon it than any other portion forming the chamber *a*. Between the inner surfaces of the band B C and the insulation surrounding the solenoid are placed copper disks F G. Upon a spindle H is mounted an iron armature I of peculiar construction, as will appear. The spindle H, is mounted in suitable bearings *j* *j'* secured upon the outside of the band B C and for convenience of construction the bearing *j'* is carried by a bracket j^2. A spring J is mounted upon the spindle H, one end being attached thereto and the other to the bracket j^2 so as to exert its tension upon the spindle H in opposition to the armature I. An indicator hand K is secured to the spindle H and a suitable scale L provided, the hand K being normally held against a pin *l* and at the zero end of the scale by the spring J. The bearings for the spindle are placed eccentrically within the chamber *a*, being preferably, for convenience of construction, located below its central axis, although the armature spindle might be placed in any position within the chamber *a* which would secure the desired relation with the circular margins of the depressions E *e* at the circumference of said chamber.

As indicated in Fig. 1, solenoid A with its casing and other connected parts is mounted upon a suitable base which also carries terminals P N to which the circuit to be indicated is connected. Suitable connections extend from the binding post P N to the terminals of the solenoid A. A suitable switch will be provided for connecting the device in circuit and cutting it out again as desired. This, however, is not shown as it forms no part, nor could it aid in the illustration thereof.

The armature I as shown comprises a pole piece *i* almost as long as the chamber is deep. The pole piece *i* has the form of a segment of a cylinder a little smaller in diameter than the chamber *a* and the said pole piece is connected by a web *h* with the spindle H. The pole piece and its supporting web or plate *h* may be made of one piece of iron properly formed or of separate pieces, as desired. Being sustained upon an axis eccentric to the margins of the tapering depressions in the iron B C and to the axial line of the chamber *a* the pole piece *i* will when in normal position present itself eccentrically to the most

strongly magnetized portions of the encircling iron. The band B C being cut away as described it is thicker at the circumference of the ends of said chamber *a* forming circular poles and therefore as the voltage or intensity of the current to be measured increases, the strength of the circular poles will increase and the eccentrically mounted armature will be drawn toward them and in being so drawn, be compelled to move in an eccentric path, necessarily rotating the spindle H, thereby overcoming the tension of the spring J and moving the needle along the scale L away from the zero point. The range of movement of the armature *i* is indicated in dotted lines the limit being reached when all parts of said armature are in the same relation to the polar circle of attraction. When in action currents will be generated in the copper disks F G which will neutralize the tendency of the armature I to swing back and forth before coming to rest at the proper point, thereby securing a steady movement of the hand K to the point indicating the nature of the current, where it will remain until the current changes or the instrument is cut out of circuit. This secures the result known as a dead beat indicator. The spring J is adjusted to act in opposition to the attraction of the poles of the magnetized envelope upon the armature I, and must be strong enough to normally hold the armature with the indicator needle in the zero position. A suitable stop *l* is provided for limiting the rearward movement of the armature I.

While I have described the iron encircling the solenoid A as a band, it may be considerably varied in form and yet perform its function of attracting the armature according to the strength of the current to be measured.

As stated although I have referred to the instrument as a voltmeter a similar construction, suitably wound and proportionate is utilized as an ammeter with equally good results. Furthermore it will be apparent that many of the details of construction may be changed or modified without departing from the spirit or nature of the invention, and I therefore do not limit myself to the exact construction set forth.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A volt or ampère meter comprising a stationary solenoid and connections therefrom to receive the current to be measured, an iron band surrounding the solenoid and magnetized thereby, and having its central portion reducing in thickness to the axis of the solenoid, an iron armature eccentrically journaled within the solenoid and free to swing toward and away from the margins of the tapering depressions in the surrounding iron, a counterbalance, and an indicating device connected with and actuated by the armature.

2. A volt or ampère meter comprising a stationary solenoid and connections therefrom to receive the current to be measured, a layer of copper upon each end of the solenoid, an iron envelope or band inclosing the solenoid and having its central portion reducing in thickness to the axis of the solenoid, a segmental iron armature eccentrically journaled within the solenoid and free to swing toward and away from the margins of the tapering depressions in the enveloping iron, a counterbalance spring, and an indicating device connected with and actuated by the armature.

3. A volt and ampère meter comprising a solenoid and connections to the circuit to be indicated, an iron band inclosing said solenoid and having its central portions decreasing in thickness to the axis of the solenoid, a copper disk at each end of the solenoid, a segmental armature eccentrically supported within the opening of the solenoid and arranged and adapted to actuate an indicator, and a counterbalancing spring connected with said armature whereby said armature is rendered free to swing toward and away from the margins of the depressions in the iron in accordance with the magnetic strength thereof due to the current in the solenoid.

4. In a volt or ampère meter, the combination of a solenoid and connections therefrom with circuit to be measured, an iron band encircling said solenoid, the central portions of said iron band increasing in thickness from the axis of the solenoid outward, a segmental iron armature eccentrically pivoted within the solenoid and adapted upon an increase of current to be drawn toward the margins of the depressions in the center of the iron and turned upon its axis at the same time, and a tension spring connected with the stationary casing and with the shaft of the armature for counterbalancing the weight of the parts whereby the movements of the armature will be in accordance with the strength of the magnetism of the iron due to the current traversing the solenoid.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN O. HEINZE, JR.

Witnesses:
STEPHEN JANNUS,
FRANKLAND JANNUS.