No. 725,765. PATENTED APR. 21, 1903.

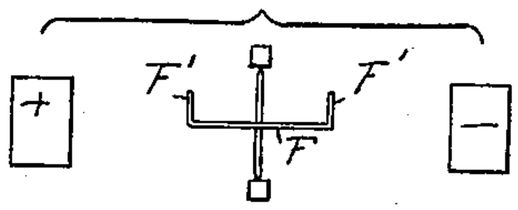
L. M. PIGNOLET.

VOLT AMPERE METER.

APPLICATION FILED SEPT. 27, 1901.

NO MODEL.

FIG.4



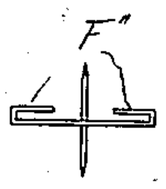


FIG.6.

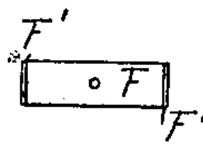


FIG.5

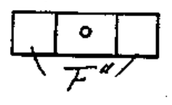


FIG.7

FIG.1

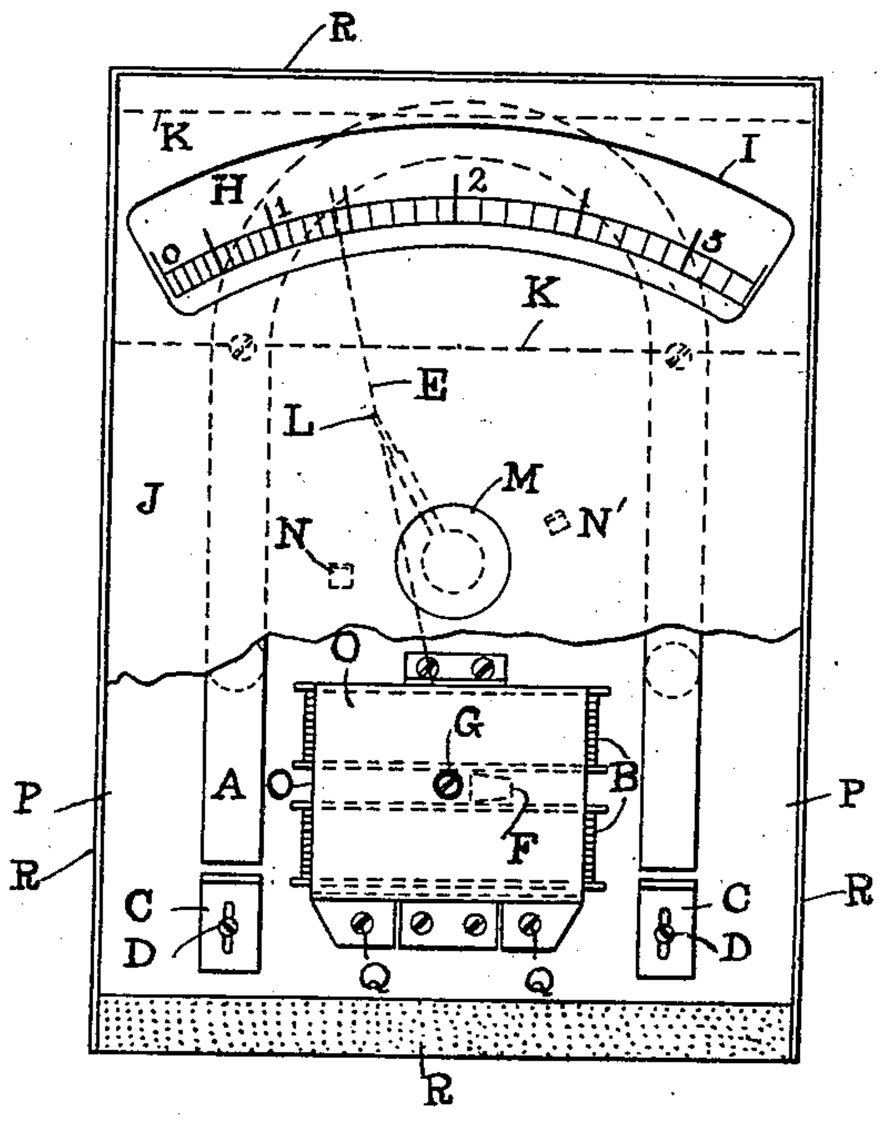


FIG.2

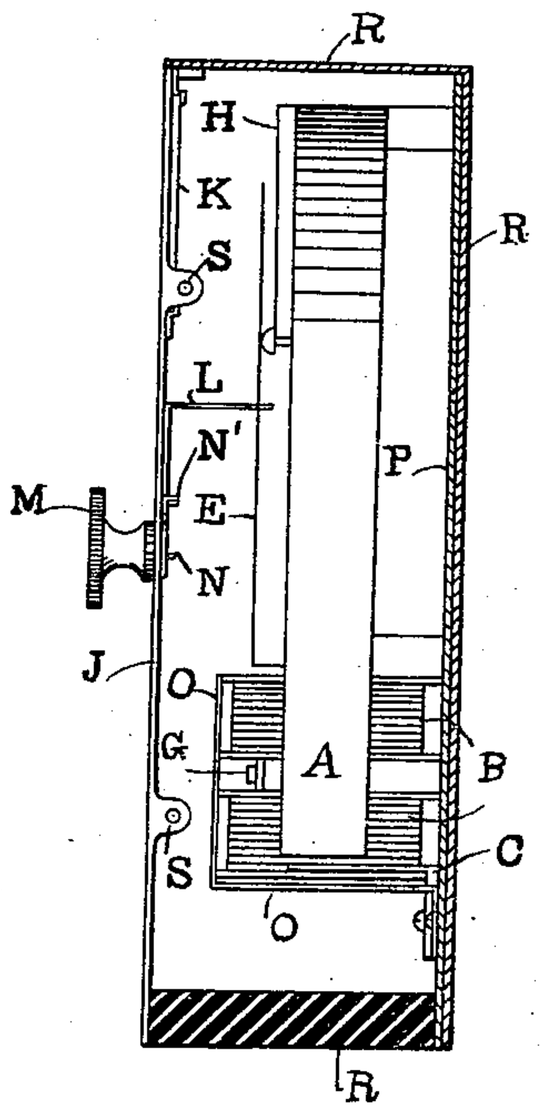


FIG.10

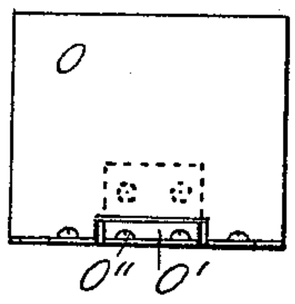
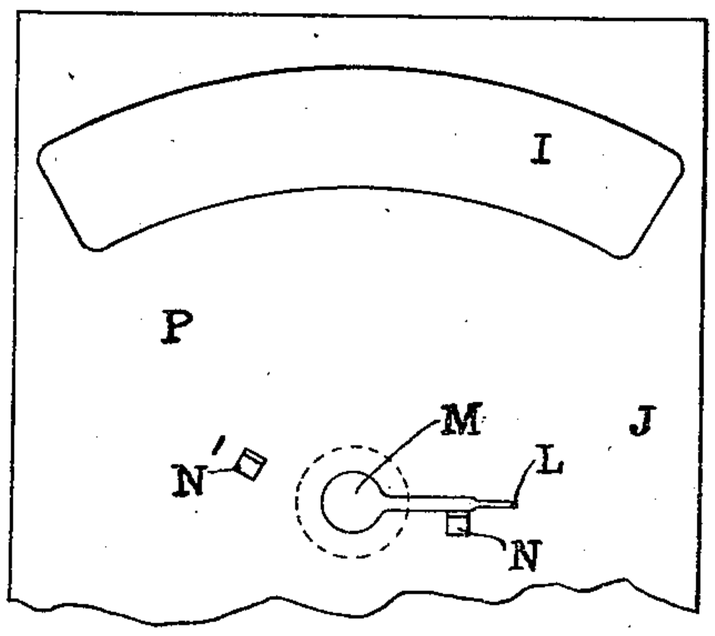


FIG.3



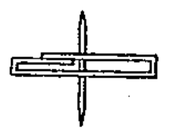


FIG.8.

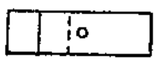


FIG.9.

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UNITED STATES PATENT OFFICE.

LOUIS M. PIGNOLET, OF ORANGE, NEW JERSEY.

VOLT-AMPERE METER.

SPECIFICATION forming part of Letters Patent No. 725,765, dated April 21, 1903.

Application filed September 27, 1901. Serial No. 76,802. (No model.)

To all whom it may concern:

Be it known that I, LOUIS M. PIGNOLET, a citizen of the United States of America, and a resident of Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Volt-Ampere Meters, of which the following is a specification.

The object of my invention is to perfect the volt-ampere meter.

The improvements appertain particularly to the type of instrument depicted in full in former Letters Patent granted to myself and James J. Bradley on October 9, 1900, No. 659,506, entitled "Magnetic regulator for galvanometers." In such instruments a delicately-swinging aluminium needle is employed as an index or pointer. When the current is turned on, the needle swings to and fro like a pendulum, but does not come to rest as soon as could be desired. By my present invention practically no time is lost in obtaining a reading on the scale. To this end a manual device is employed to stop the needle from swinging, except through a very small arc, at about the degree which one can judge to be the stopping-point, approximately.

My invention also involves means for obtaining greater accuracy in the reading by preventing influences from acting thereon from outside sources, such as iron and magnets. In the former patent the remedy I find is fair as far as it goes. I now construct the instrument not only with an iron shield under the same and contiguous to the outside of the solenoid, but I also have been able to so construct the device as to practically perfect the shielding of the armature to which the needle is attached. I provide an iron sheet extending from the iron base-plate, so as to cover one end of the solenoid and also the top, where the iron sheet is on the opposite side of the solenoid, measured from the base-plate.

My invention also includes means for increasing the certainty of reading the higher voltages with greater accuracy. Engineers and users and manufacturers have desired a small pocket instrument adapted to indicate as high as two hundred and fifty volts, by larger and larger movements of the needle the higher and higher the voltage, and at the same time to have a short range of the needle. The device embodying my invention accomplishes this result effectually, as proved by actual tests. I provide, in combination, an armature for the needle of such a construction that the electromagnet of the meter causes greater and greater throws of the needle the more the poles of the armature depart from the poles of the permanent magnet.

More particularly the nature of the improvement is described as follows: Heretofore in order that there be a sufficient magnetic attraction between the permanent magnet and the iron armature to give a positive control of the armature the latter is made thick, but objectionably heavy. For example, an armature one-half inch long would be about one-eighth inch thick, which makes a heavy armature for a delicate instrument. When such an armature is set in motion by the current to be measured, it oscillates for a comparatively long time on account of its great weight before coming to rest and permitting a reading to be taken. If the armature be thinner—merely, for example, one thirty-second of an inch thick—it will come to rest quicker; but the magnetic attraction on the thin armature is so weak that it has not enough strength to overcome the slight friction of the pivots in their bearings, and the armature will not always come to rest in the same position with the same current through the solenoid, which causes the indications of the needle attached to the armature to be unreliable. However, I find that by providing a thin armature—for example, of material about one thirty-second of an inch thick—with enlarged polar surfaces at the ends only, the attraction of the magnet upon the thin armature is largely increased, so that the objections mentioned above are overcome. These three improvements are therefore important when taken in conjunction with each other and with the other details, because the device may be manufactured more cheaply and yet with an improved output, and, moreover, the reading is more accurate and may be taken more rapidly, and the instrument may be employed regardless of surrounding masses of iron or magnets. The shielding effect is not the only nor the most important object of the iron base-plate and the iron at the end and top of the solenoid. The object of the iron

base is fully set forth in the former patent heretofore referred to.

Figure 1 is a plan taken from a full working device drawn to scale. A part of the face-plate or cover is broken away. The important parts under the face-plate are represented by dotted lines. Fig. 2 is a view partly in section and so taken as to best indicate the interior construction. Fig. 3 is an inverted plan of the main part of the face-plate, so as to show the under side thereof. Fig. 4 is a diagram to illustrate the action of the magnets upon the armature. Fig. 5 is a plan of the armature in Fig. 4. Figs. 6 and 7 are respective elevation and plan of a different armature for the same purpose as in Figs. 4 and 5. Figs. 8 and 9 are elevation and plan of a further modification. Fig. 10 is an end view of the iron plate O, having a hole at its lower central portion for the entrance of the small angle-iron O', which holds the electromagnet to the base P by screws O''.

The circuits for this instrument may be found described in said patent, but are not here described again, because they have nothing to do with the novelty of the invention.

A is the permanent magnet of the meter.

B is the solenoid between the poles of the magnet A.

C represents armatures for the magnet A, adjustable to and fro by means of screws D, passing through slots in the armature C. A part of the armature for the solenoid and to which the needle E is attached is shown at F. Said armature is rotary about the pivot G through a sufficiently long arc. At the end of the needle and under the same is a scale H, which may be seen through the hole I in the face-plate J, covered with glass K and having divisions longer and longer toward the right. For evident reasons when a current is sent through the instrument the needle E oscillates back and forth, and after quite a long time it will come to rest. To prevent these repeated oscillations, I provide a finger adapted to be adjusted to substantially any portion of the path of the needle E. For this purpose the finger L is carried upon a thumb-screw M, which turns in the face-plate J and is on the outside thereof, while the finger L is on the inside.

N and N' represent stops on the under side of the plate J, between which the finger L can be adjusted by means of the thumb-screw M. The finger is bent at right angles to itself, one portion lying flat against the plate J and the other portion projecting therefrom.

The operation is as follows: Suppose each one of a number of storage-cells is to be tested and that each has an electromotive force of about two volts. In the ordinary instruments the pointer is at zero and after connection is made with a cell swings from zero to a point considerably beyond two volts, then returns toward zero, and continues to move back and forth in lessening oscillations till it finally comes to rest at two volts. For example, the pointer may move from "0" to "3.3," then back to "1," up to "3.0," back to "1.6," up to "2.2," back to "1.9," then to rest at two volts. By my device the thumb-screw M is turned so that the finger L pushes the needle till it points to "1.6" volts, for example, where it is allowed to rest. The needle E cannot move toward "0" on account of finger L, but is free to move in the opposite direction. When connection is made with a cell, referring to the example given above, the needle E will move from "1.6" to "2.2," then return to "1.9," and then come to rest at two volts. The other oscillations mentioned in the above example are thus omitted, and the needle comes to rest proportionally quicker, probably saving more than half the time.

The stop N' is to limit the movement of the finger L, which otherwise might push the needle beyond the scale and against the side of the voltmeter-box, and thus bend or damage the needle. The stop N' is so located as to prevent the needle from being pushed beyond "3.3" volts on the scale and against the side of the box.

The supplementary shield O is a small angle-iron which extends over one end of the solenoid, where it is attached to the iron base-plate P by screws Q, and the other portion of the angle-iron extends over the top of the solenoid B on the side opposite the plate P, and it extends substantially the full length and width of said solenoid. The mathematics would be too complex for showing the exact dimensions of this shield for the best results; but the instructions given above when followed are sufficiently approximate for practical purposes.

R is a box in which the whole instrument is inclosed.

S represents lugs by which the plate P may be screwed to the box R. These lugs are not shown in Figs. 1 and 3, as they have no importance as to novelty.

Any other details not lettered or described have nothing to do with the invention.

The shield O only has its valuable use when taken in conjunction with the plate P; but as it has a proportional use without said plate I intend that my invention includes said plate.

The iron plate P, permanent magnet A, solenoid B, and shield O are all within inductive action of one another, and the solenoid is between the poles of the horseshoe-magnet A.

An essential feature of the invention is the armature for coöperating with the finger L and needle E and scale I for effecting the result of accurate and quick reading of the voltage. In Fig. 1 the armature is too small and too much hidden to be explained. By referring to certain other figures its construction may be made plain. The armature F consists of a small and narrow plate of iron purposely having a maximum surface at a certain location of a certain shape and of a certain direction, but at the same time as lit-

tle mass as possible, so long as it has sufficient mechanical strength and magnetic capacity. In Figs. 4 and 5 this object is accomplished by providing bent-over ends F′, which must face the poles + and — of the permanent magnet A when at rest in its normal position with no current passing through the electromagnet B. When the current is turned on, the electromagnet is energized and the flanges F′ no longer face the permanent magnet, but gradually stand at a greater and greater angle thereto, with the desired result that equal increments of current produce unequal and larger deflections of the armature F, and hence of the needle E. The explanation of this fact (determined by experiment) is supposed to be due to less and less surface of metal in the path of the lines of magnetic force from the permanent magnet; but the explanation is immaterial, for the fact remains the same. By means of the armature in Figs. 6 and 7, where the ends F″ are bent backward nearly upon themselves, with a space between, a similar result is obtained, and this construction is employed when deflections are desired of less difference in their lengths than those obtained by the armature shown in Figs. 4 and 5. A similar result is obtained by the further extension of the ends to meet, forming a complete loop or oval, as in Figs. 8 and 9.

I claim as my invention—

1. In an electric meter, the combination with the solenoid thereof, of an iron plate covering two sides and one end of said solenoid.

2. In an electric meter, the combination of a permanent magnet, a solenoid within inductive action thereof, a plate of iron on one side of said elements and within inductive action thereof, a needle governed by said solenoid, and an angle-iron, whose portions are respectively at the end of said solenoid and at that side which is opposite said plate.

3. In an electric meter, the combination of a permanent horseshoe-magnet, a solenoid between the poles thereof, a needle governed by said solenoid, and an iron plate shielding said solenoid on more than one side thereof.

4. In an electric meter, the combination of an oscillating needle and a back stop finger L adjustable in the path of said needle and located entirely to one side of said needle.

5. In an electric meter, the combination of a box R containing the same, a face-plate covering said box, an oscillating needle for the meter, a bent finger having one portion adjacent to said plate and the other portion extending to the path of said needle, a thumb-screw for turning said finger and located on the opposite side of said plate, and stops lying in the path of said finger.

6. In an electric meter, the combination of a containing-box, an oscillating needle for the meter, a finger for moving said needle forward, and a stop for limiting the forward movement of the finger, and so located that the finger cannot push the needle against the side of the containing-box or other obstruction.

7. In an electric meter, the combination with the permanent magnet thereof, of a pivoted armature between the poles of said magnet, consisting of a sheet of iron or steel with turned-over ends which face said poles, and a solenoid for rotating the turned-over ends of said armature away from said poles; a pointing-needle carried by said armature, and a finger adapted to push said needle along the indicating-scale of said meter.

8. In an electric meter, the combination with the permanent magnet thereof, of a pivoted armature between the poles of said magnet, consisting of a sheet of iron or steel with turned-over ends which face said poles, and a solenoid for rotating the turned-over ends of said armature away from said poles.

9. In an electric meter the combination with a permanent magnet, and with the solenoid, of an armature to be actuated by said elements and consisting of a plate of iron so shaped that more surface faces the poles of the magnet in the normal state of said armature, than when turned to any abnormal position by the action of the solenoid.

10. In an electric meter, the combination with a permanent magnet, and with the solenoid, of an armature to be actuated by said elements and consisting of a plate of iron so shaped that more surface faces the poles of the magnet in the normal state of said armature, than when turned to any abnormal position by the action of the solenoid, an oscillating needle carried by said armature, and an adjustable stop-finger and stop in the path of said needle.

11. In an electric meter, the combination of an indicating-scale, an operating-needle, and a stop-finger adjustable in the path of said needle and located on the zero side of the needle.

12. The combination of a containing-box, a meter therein an indicating-scale for the meter, a needle for the meter, a cover for the box directly over the needle, and a stop-finger over said needle pivoted upon said cover and having its free end portion bent downward into the path of said needle, and a handle for said finger, and connected therewith and located on the other side of said cover from said finger.

13. The combination of a containing-box, a meter therein, an indicating-scale for the meter, a needle for the meter, a cover for the box directly over the needle, and a stop-finger over said needle pivoted upon said cover and having its free end portion bent downward into the path of said needle, and a handle for said finger, and connected therewith and located on the other side of said cover from said finger, and stationary stops on opposite sides of said needle and in the path thereof.

14. The combination of a containing-box, a meter therein, an indicating-scale for the meter, a needle for the meter, a cover for the box

directly over the needle, and a stop-finger over said needle pivoted upon said cover and having its free end portion bent downward into the path of said needle, and a handle for said finger, and connected therewith and located on the other side of said cover from said finger, and stationary stops on opposite sides of said needle and in the path thereof, said finger being located to one side of the needle for preventing it, at option, from returning to the zero of said scale.

In testimony whereof I hereunto sign my name and affix my seal this 6th day of September, 1901.

LOUIS M. PIGNOLET. [L. S.]

Witnesses:

A. C. BOUGHTON,

A. SMIETON.