(No Model.)

W. H. BRISTOL.

ELECTRICAL MEASURING INSTRUMENT.

No. 533,270. Patented Jan. 29, 1895.

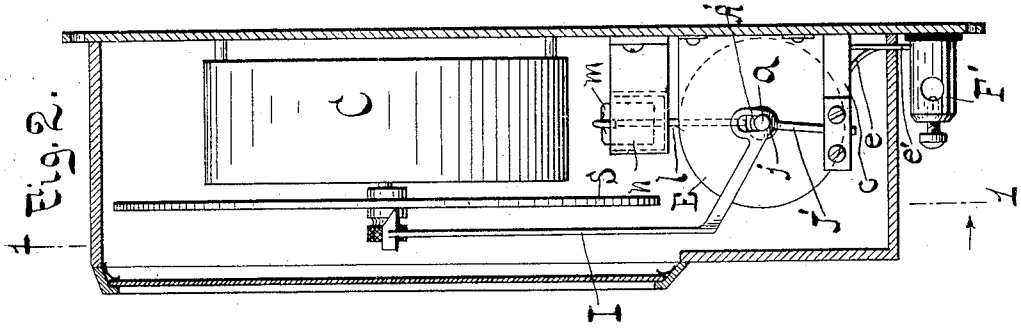

Fig. 2.

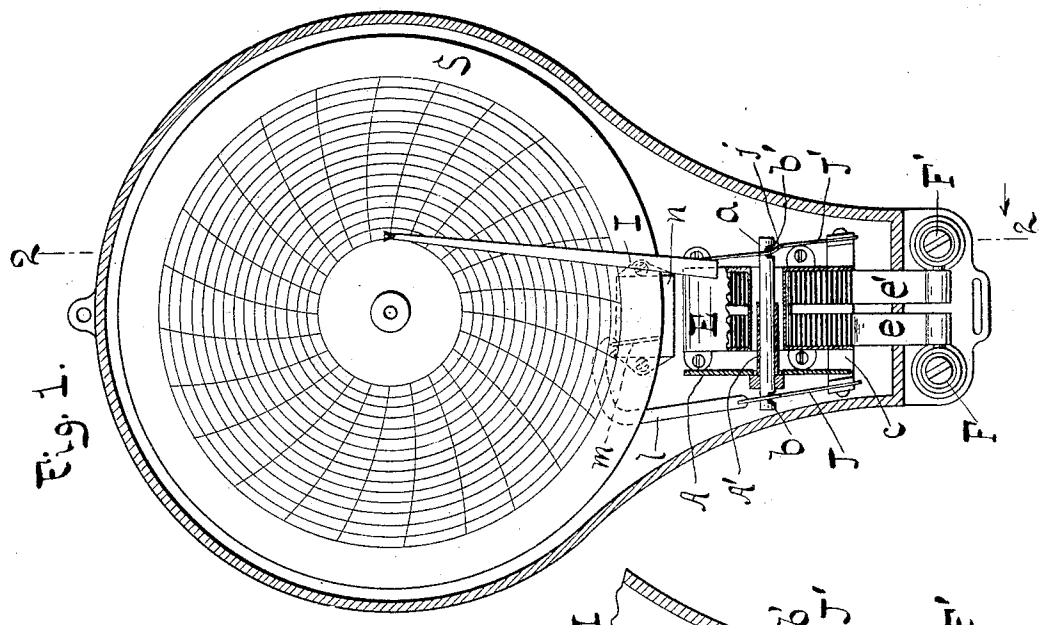

Fig. 1.

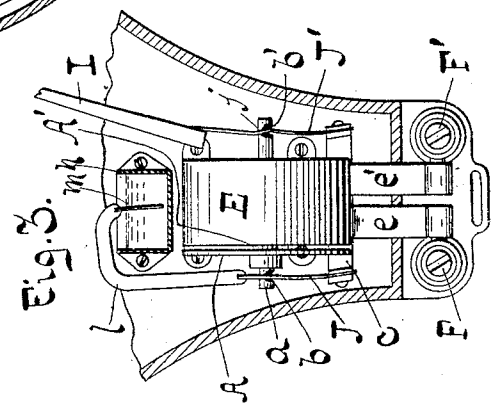

Fig. 3.

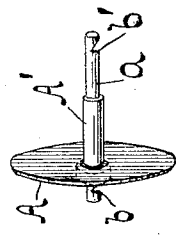

Fig. 4.

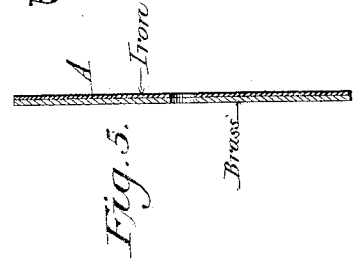

Fig. 5.

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ELECTRICAL MEASURING-INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 533,270, dated January 29, 1895.

Application filed September 24, 1894. Serial No. 523,874. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. BRISTOL, a citizen of the United States of America, and a resident of Hoboken, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Electric Measuring-Instruments, of which the following is a specification.

My invention has reference to electrical devices of that character especially adapted for use in galvanometers, ampère-meters, and similar instruments for indicating and recording an electric current, or the work done thereby.

It has for its objects to provide a sensitive instrument, such as an ampère-meter, in which the divisions of the scale are quite uniform and in which the vibrations of the moving armature, due to inertia, are reduced to a minimum,—whereby the instrument is rendered practically "dead beat,"—and an accurate and easily read record produced. With these objects in view, I construct the metallic armature in the form of a thin disk, making it as light as possible in all respects, so as to reduce the momentum acquired to a minimum, and provide a damping device offering a resistance to the movement of the armature toward and from the attracting coil, which prevents the indicating or recording arm from being carried to any appreciable extent beyond the position corresponding to the current in case of sudden fluctuations in the strength of the same, and in general prevents undue vibration of the armature. I also provide the armature with a core entering the coil or solenoid and so arranged that it offers increased magnetic resistance to the motion of the armature as it approaches the coil or solenoid and permits the scale to be made quite uniform.

The nature of my said invention will best be understood when described in connection with the accompanying drawings, in which—

Figure 1 represents a vertical section in the plane 1—1, Fig. 2, of an ampère-meter embodying my invention. Fig. 2 is a vertical cross-section in the plane 2—2, Fig. 1. Fig. 3 is a sectional front elevation, part being broken away. Fig. 4 is a perspective detail of the armature and its shaft. Fig. 5 is a cross-section of a bi-metallic armature drawn to a larger scale than the preceding figures.

Similar letters of reference designate corresponding parts throughout the several views.

Referring to the drawings, the letter E designates a coil or solenoid secured to the back of the casing, and A is a movable armature arranged in line with the coil E.

The armature A is secured to a horizontal non-magnetic shaft *a* passing through the coil or solenoid E and having at opposite ends V-shaped notches *b b'*. The notches rest on knife edges formed in flexible supports J J' secured to a suitable bracket *c* affixed to the back of the casing. The coil or solenoid E has its terminals *e e'*, connected to binding posts F F' secured to the casing.

To an extension of the flexible support J' is secured a pointer, recording arm, or like device I arranged adjacent to a scale or chart S in the usual manner. In this instance I have shown a recording arm attached to the support J' and having a style bearing on a chart S, to which latter a rotary motion is imparted by a suitable clock movement C.

It will be readily seen that when the armature A moves toward the coil or solenoid E, the flexible support J' is deflected about its point of attachment and consequently the recording arm I, which practically forms a prolongation of said support, participates in said movement about the point of attachment of the support as a center, and moves through a greatly increased arc, thereby permitting levers and similar multiplying devices to be dispensed with.

As before stated the main objects of my present invention are, first, to reduce to a minimum the vibrations due to the inertia of the armature and, secondly, to obtain a uniform scale.

Relative to the vibrations I attain the end sought by making the armature quite thin and light, preferably in the form of a disk about two and one half inches in diameter and 0.005 inches thick. The disk is preferably made bimetallic, say, of iron and brass, the iron being, as stated, very thin to reduce the error due to magnetic lag to a minimum, while the brass or other non-magnetic metal imparts strength and rigidity to the disk.

The iron, as before stated, is made about .005 of an inch thick, while the brass is about .025 of an inch in thickness. In view of the small weight set into motion, the moment of inertia is small. To reduce this moment I provide a damping device constructed as follows: To the flexible support J is secured a bent arm *l* having attached thereto a vane *m* disposed in a small cup or box *n* containing a liquid, for instance, glycerine. The vane participates in the movement of the armature A, and, similarly to the recording arm, moves through a greater space.

It will be readily seen that the vane moving through the liquid has a retarding influence on the motion of the armature, thereby preventing excessive movement in case of a sudden increase or decrease in the strength of the current.

To the shaft *a* of the armature A is attached a light core A′ which enters the coil or solenoid E and extends, when in its normal position, to, or about to, the center of the same, in which position the attractive force of the solenoid on the core is at its maximum.

The disk portion of the armature A, when in its normal position, is least attracted by the solenoid E, but, as it approaches the same, the attraction increases. The magnetic force on the disk portion increasing as it approaches the solenoid, and the magnetic force on the core A′ decreasing as it moves inwardly, the combined effect is to produce a substantially constant magnetic attraction on the whole armature. Consequently, the divisions of the chart can be made quite uniform.

To prevent the notch *b′* in shaft *a* from slipping out of the support J′, the latter is preferably provided with an oblique portion *j* and one side of the notch *b′* is cut substantially at right angles to the shaft.

The coil or solenoid is preferably formed of coils of flat bands having their inner ends united, so that both terminals lead from the exterior of the compound coil thus formed, (Fig. 1.)

I do not wish to restrict myself to the specific devices for supporting the armature or to the means for imparting the motion of the armature to an indicating or recording device.

What I claim as new is—

1. In an electrical measuring instrument, the combination of a coil or solenoid, a light disk-armature arranged opposite said coil, a swinging support for said armature, and an indicating or recording device, in connection with said support, substantially as described.

2. In an electrical measuring instrument, the combination of a coil or solenoid, a light disk-armature arranged opposite the same, a core moving with said armature and entering the coil or solenoid, and an indicating or recording device operated from said armature, substantially as described.

3. In an electrical measuring instrument, the combination of a coil or solenoid, a shaft held in flexible supports, a light disk-armature mounted on the shaft, a core forming part of said armature and entering the coil or solenoid, and an indicating or recording arm secured to one of the flexible supports, substantially as described.

4. In an electrical measuring instrument, the combination of a coil or solenoid, an armature arranged adjacent to the same, a core moving with said armature and entering the coil or solenoid, a damping device operated by the movements of the armature, and an indicating or recording arm, substantially as described.

5. An armature for electrical measuring instruments composed of a shaft, a flat disk-armature mounted on said shaft, and a core surrounding the shaft, substantially as described.

6. An armature composed of a thin disk of iron and a reinforcing plate of non-magnetic material, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 20th day of September, 1894.

WILLIAM H. BRISTOL.

Witnesses:
CHARLES W. THOMAS,
A. FABER DU FAUR, Jr.