(No Model.) 3 Sheets—Sheet 1.

S. Z. DE FERRANTI.

ELECTRIC METER.

No. 408,295. Patented Aug. 6, 1889.

Fig. 2.

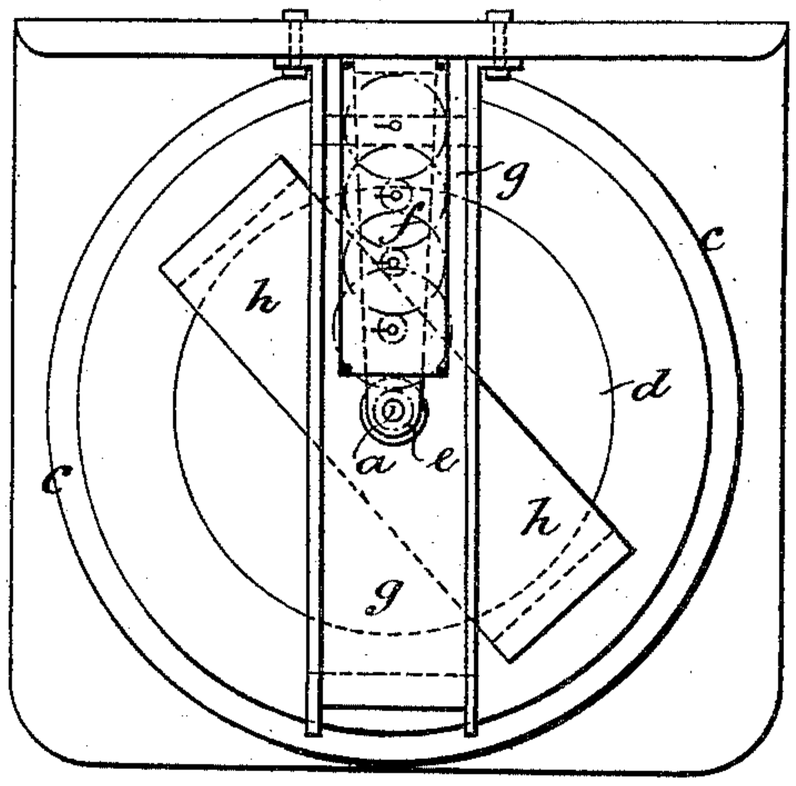
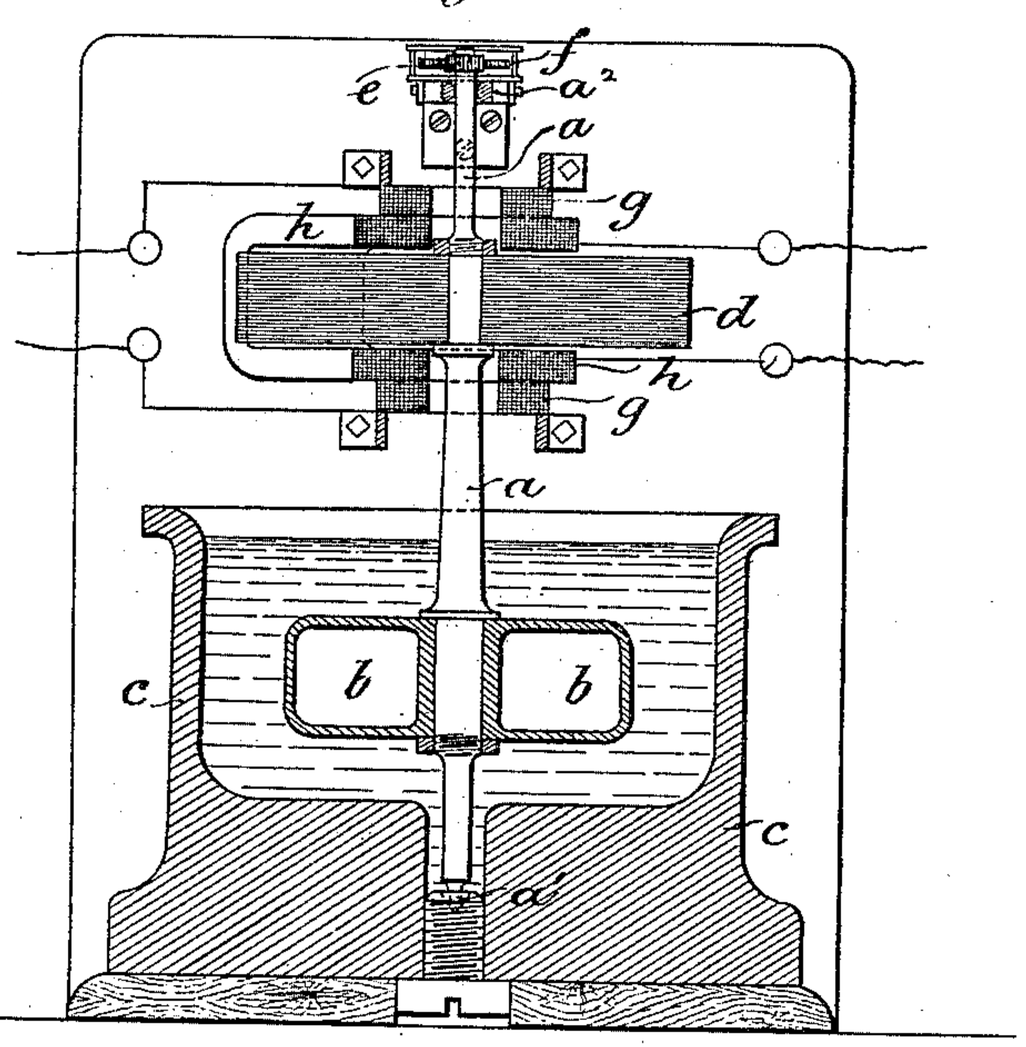


Fig. 1.



Witnesses.
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(No Model.) 3 Sheets—Sheet 2.

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Fig: 3.

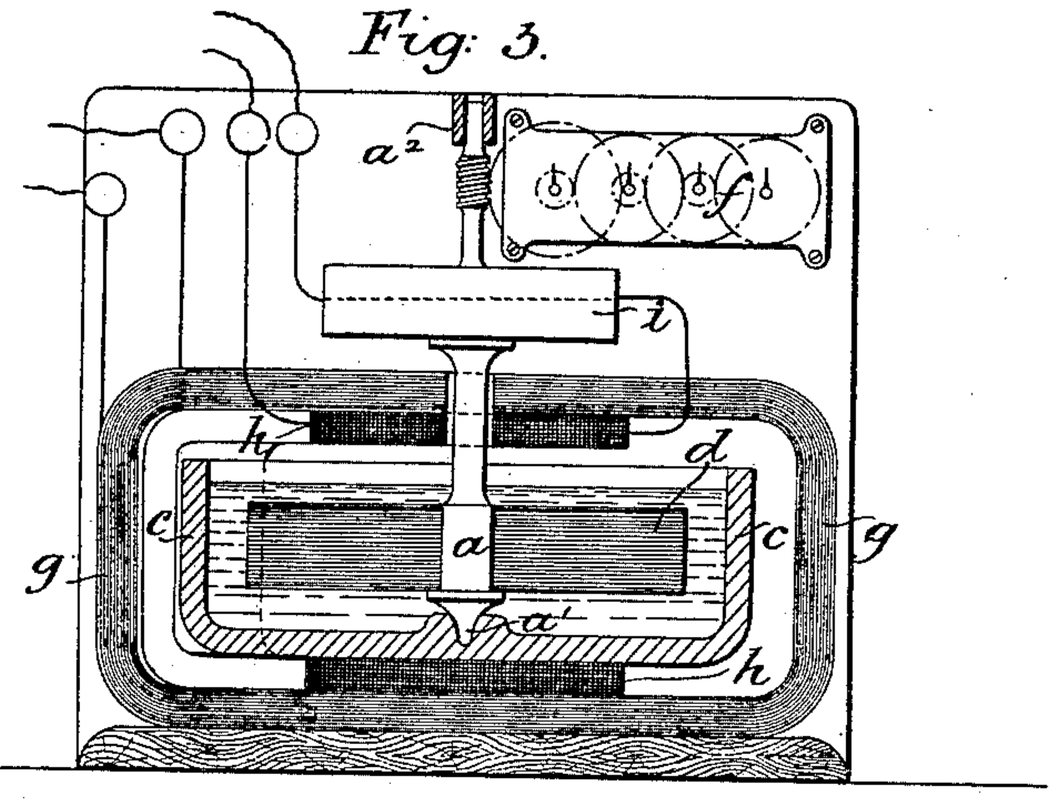
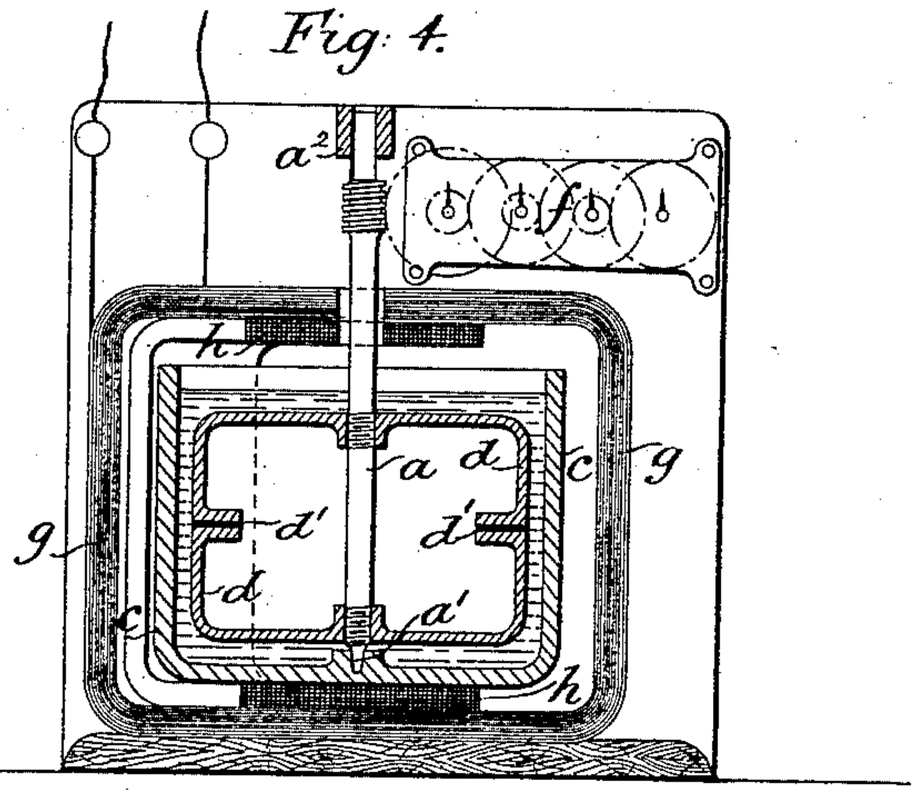


Fig: 4.



Witnesses.

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(No Model.)

3 Sheets—Sheet 3.

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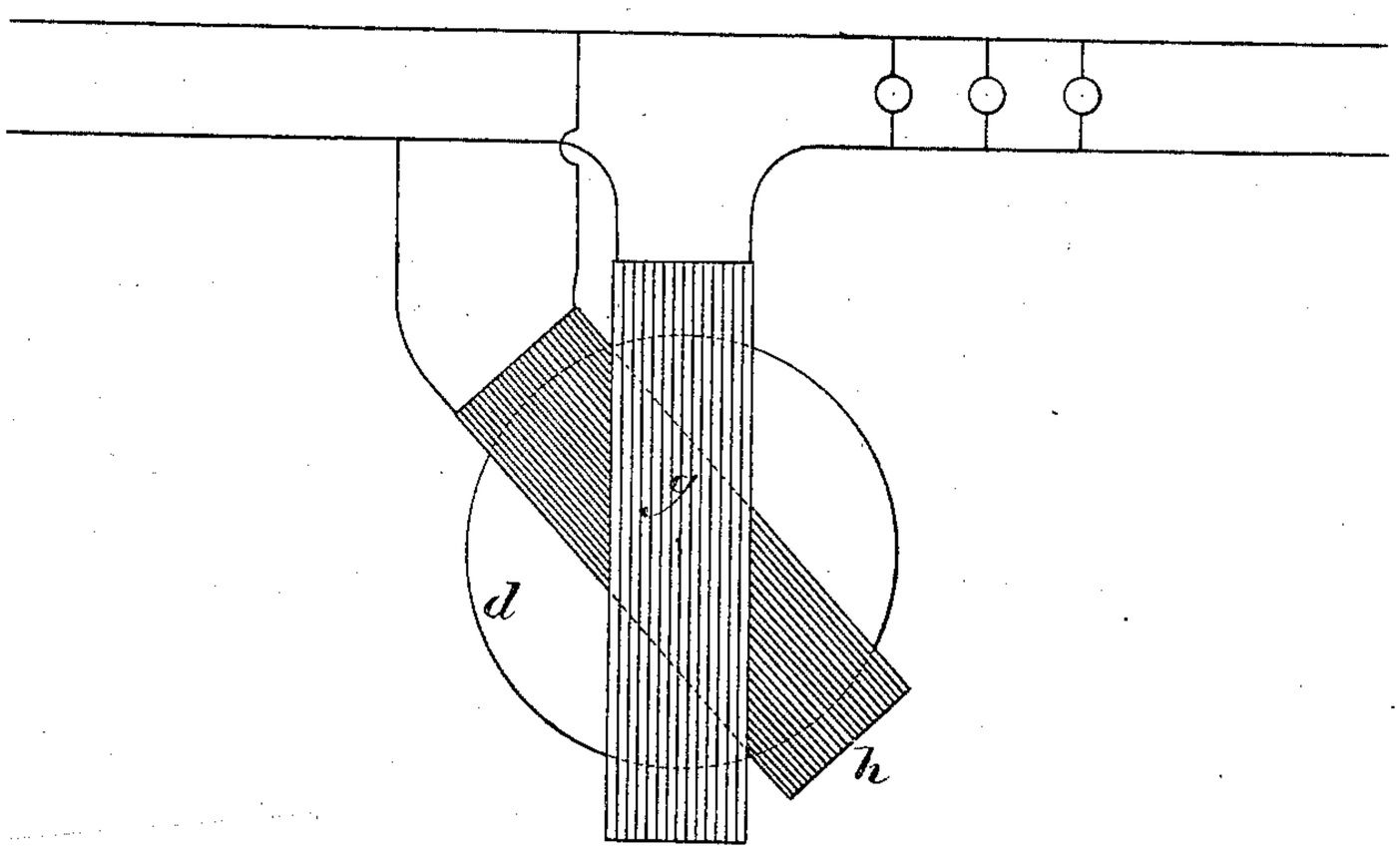
Fig. 5.



WITNESSES

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UNITED STATES PATENT OFFICE.

SEBASTIAN ZIANI DE FERRANTI, OF HAMPSTEAD, COUNTY OF MIDDLESEX, ENGLAND.

ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 408,295, dated August 6, 1889.

Application filed October 10, 1888. Serial No. 287,735. (No model.)

To all whom it may concern:

Be it known that I, SEBASTIAN ZIANI DE FERRANTI, electrician, a subject of the Queen of Great Britain, residing at 120 Fellowes Road, Hampstead, in the county of Middlesex, England, have invented certain new and useful Improvements in Electric Meters, of which the following is a specification.

This invention relates more especially to the class of alternate-current meters in which an unwound magnetic armature is employed and is magnetized by coils, so as to produce diametrically-opposite poles, and in which the armature so magnetized is contained in a magnetic field induced by other coils, from which arrangements movement results. Now, in such meters it has been usual for the armature to be a light disk of iron in one piece; but so constructed the meters do not perform well. I obtain much better results by using a heavier armature built up in layers or of laminæ insulated the one from the other. In order to lessen the friction on the pivot which otherwise would result from the increase of mass, I partially float the armature in a liquid, or I fix a float upon the lower part of the armature-spindle beneath the armature. The float in these meters may replace the fan and serve to produce the necessary retardation; also, I magnetize this armature by means of a coil of comparatively few turns. These precautions I take in order that the magnetization of the armature may not approach saturation. Sometimes I make the armature with laminæ of steel in lieu of iron. The method described of partially floating the armature is applicable also to meters of other constructions. The float may be entirely immersed to avoid the effect of surface tension. The armature, when itself immersed, may be hollow to increase its flotation; or, if a heavy liquid like mercury be employed, a weight in air may be applied to overcome the flotation of the armature.

In order that my said invention may be fully understood and readily carried into effect, I will proceed to describe the drawings hereunto annexed.

In the drawings, Figure 1 is a vertical section of a meter constructed in accordance with my invention. Fig. 2 is a plan of the same. Fig. 3 is a vertical section and shows a modification. Fig. 4 is a vertical section and shows another modification. Fig. 5 is a diagram showing a way of connecting the coils in circuit.

In Figs. 1 and 2, *a* is a spindle. It has a pivot a' at its lower end and a bearing a^2 at the top. Upon this spindle is a float *b*, which may or may not be hollow. The float is contained in a vessel *c*, containing liquid. Mercury may be employed, in which case it is essential that the float should be completely immersed. With other liquids this is less important. *d* is the armature, also mounted on the spindle *a*. *e* is a pinion on the spindle *a*, giving motion to the train of counting-wheels *f*. This is an ordinary meter-train. *g* is a coil in which the current to be measured flows. It is an alternating current, derived, usually, from a dynamo. *h* is another coil, in which also an alternating current is passed. This second current is usually derived from a shunt across the leads, and so the second current remains approximately uniform whatever may be the fluctuation of the main current passing in the coil *g*. This arrangement of the coils forms, however, no part of my invention. Such circuit-connections are shown in Fig. 5. The two coils produce in the armature polarization on intersecting lines and the armature is caused to rotate. The armature *d* is built up of disks of iron or steel. These disks should not exceed one-hundredth of an inch in thickness, and they should be insulated the one from the other with thin paper. The weight of the disks in this armature should not be less than one-third ounce per convolution of the coil *g* for a maximum current of one hundred ampères passing by the said coil through the meter, and so in proportion for a larger or smaller current. The object in adopting these dimensions is to insure that the magnetization of the iron in the armature shall in no case approach saturation. In some cases I make the armature of laminæ of steel in place of iron. This is expedient when the alternations of the current are less rapid than is usual.

In Fig. 3 the armature *d* is shown immersed

in mercury contained in a vessel *c* within the coils, and a weight *i* compensates the excessive flotation of the armature.

In Fig. 4 an armature consisting of a hollow shell of thin iron is represented. It is made in two parts insulated from each other at *d'*. This armature is immersed in a light liquid, such as paraffine-oil.

In each case the flotation is so adjusted as to leave but little pressure on the pivot at *a'*.

I claim—

1. In an electric meter, the combination, substantially as set forth, with the stationary coils, of an unwound rotating armature magnetized thereby, said armature being built up of insulated laminæ of iron or magnetic metal, and the mass of metal being so related to the resistance of the coil, as herein described, that the current in the coil cannot magnetically saturate the armature.

2. In an electric meter, the combination, substantially as set forth, of the stationary coils and an unwound rotating armature magnetized thereby, the mass of metal in the armature being so related to the resistance of the coil, as herein described, that the current in the coil cannot magnetically saturate the armature.

3. In an electric meter, the combination of an unwound rotating disk-armature, stationary coils in planes at right angles to the plane of the disk, said coils magnetizing the disk, and a body of fluid in which the weight of the armature is floated or partly floated to lessen the weight upon its pivot.

4. In an electric meter, a rotating armature mounted on a spindle, which also carries a float immersed in liquid, whereby the weight of the armature upon its pivot is lessened.

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