

(No Model.)

2 Sheets—Sheet 1.

T. BRUGER.
ELECTRIC METER.

No. 531,153.

Patented Dec. 18, 1894

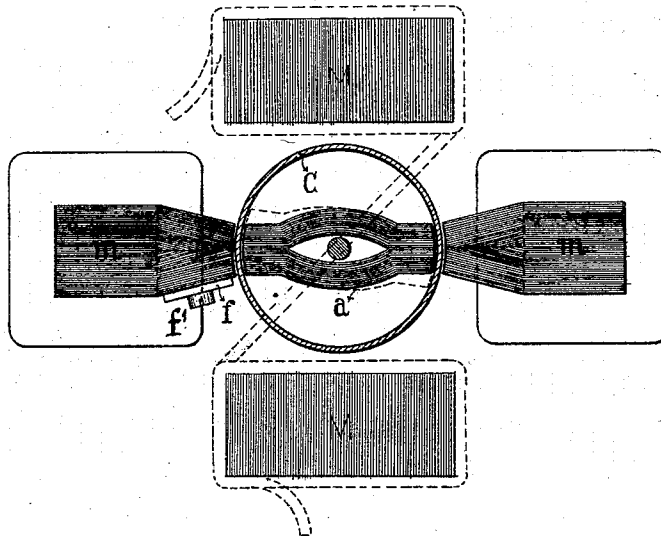


Fig. 1.

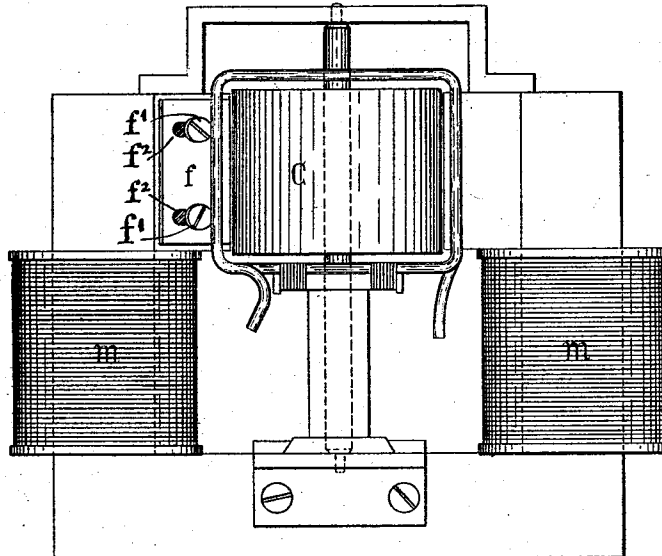


Fig. 2.

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(No Model.)

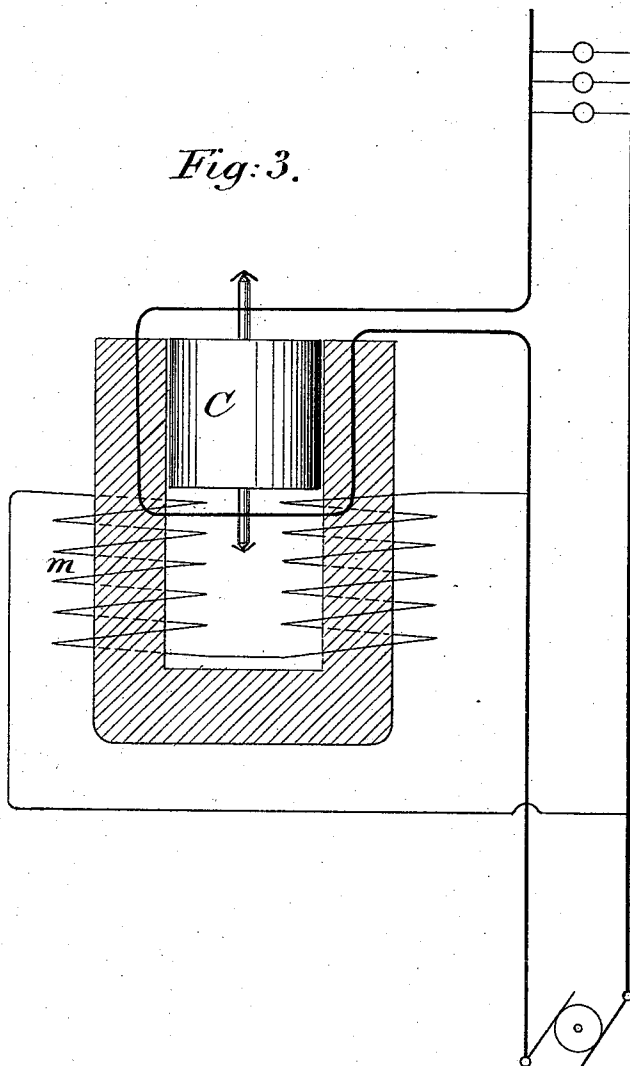
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Fig. 3.



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UNITED STATES PATENT OFFICE.

THEODOR BRUGER, OF BOCKENHEIM, NEAR FRANKFORT-ON-THE-MAIN,
GERMANY, ASSIGNOR TO HARTMANN & BRAUN, OF SAME PLACE.

ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 531,153, dated December 18, 1894.

Application filed June 22, 1894. Serial No. 515,392. (No model.)

To all whom it may concern:

Be it known that I, THEODOR BRUGER, a subject of the Emperor of Germany, and a resident of Bockenheim, near Frankfort-on-the-Main, Germany, (assignor to the Firm of HARTMANN & BRAUN, of said Bockenheim), have invented certain new and useful Improvements in Electrical Meters, of which the following is a specification.

10 This invention relates to an improved alternating current meter, which is based on the principle stated by Ferraris, according to which intersecting alternating current fields with shifted phase impart a rotary motion to
15 a rotatory metallic body, when the same is subjected under suitable conditions to their influence.

My improved alternating current meter is more especially designed for the purpose of
20 obtaining first, by a specially effective disposition of the field-magnets a certain ratio between the main magnetic-field and the main-current to be measured, which ratio can take place within broad limits; secondly, to
25 increase as much as possible the phase-movement between the main-field and shunt-field, and lastly, to render the damping action which is exerted by the magnetic field of the shunt-current on the rotatory metallic body as constant as possible and also relatively very great
30 as against the damping action that is produced by the induction of the main-magnetic field and at the same time to make it variable therewith.

35 My improved alternating current meter is shown in the accompanying drawings, in which—

Figure 1 represents a horizontal section; Fig. 2, a side elevation of a slightly modified
40 form of the same. Fig. 3 is a diagrammatic view showing the shunt electro-magnet arranged in parallel circuit with the lamps.

Similar letters of reference indicate corresponding parts.

45 Referring to the drawings, *m* and *M* represent two electro-magnets, which are arranged at right angles to each other so as to form intersecting magnetic fields, said magnets being so arranged and dimensioned that the
50 electro-magnet *m*, which is fed by a circuit parallel with the lamps, is made considerably

smaller in cross-section and is saturated in a much stronger manner than the electro-magnet, *M*, which is excited by the main-current and made with a comparatively large
55 cross-section. Inside of the poles of the electro-magnet *m* is located a hollow rotatory cylinder *C*, and within the same is arranged an iron armature *a*, which is so arranged that it closes the magnetic field, which is arranged
60 parallel with the lamps or other translating devices, while the fields of the main electro-magnet *M* is but little influenced by said armature. The armature *a* is, like the cores of
65 the electro-magnets, made of laminated iron, and is placed in line with the center-line of the poles of the shunt-electro-magnets. The ends of the armature *a*, are arranged as close as possible to the inner surface of the rotatory cylinder *C* and are made of equal or
70 nearly equal width with the ends of the poles of the electro-magnets *m*, so that between the armature and the main electro-magnet a comparatively large separating air-space is
75 formed, while furthermore owing to the location and direction of the iron laminae of the armature, a considerable magnetic resistance is exerted to the direction of the magnetic-field of the main electro-magnet *M*.

With the magnetic-fields arranged in the
80 above-described manner the poorly-saturated main electro-magnet can be replaced by one or more solenoids, as shown in Fig. 2, while the shunt-magnet and its connecting armature have to be retained always as such. In
85 both cases, especially in the latter, a very large interval, in which the speed of rotation remains proportional to the strength of the current is produced; first, because the strong and constant electric damping supplied by
90 the so-called Foucault-currents that are almost entirely generated in the shunt magnetic-field overcome the very small amount of damping produced by the variable effect of the main magnetic-field, and secondly, because the main magnetic-field is proportional
95 to the main-current.

Only in very weak currents the influence of the friction is noticed and this can be entirely obviated by the following simple
100 arrangement: On one or on both pole ends of the shunt electro-magnet are arranged at one

side iron plates f , which are shown in Figs. 1 and 2 and which are attached to the pole ends by means of screws f' passing through slots f^2 in said plates, so that they can be adjusted closer to or farther away from the rotating copper-cylinder, whereby a symmetrical arrangement of the field is effected. The iron plates are so adjusted that the shunt-electro-magnet alone exerts a slight rotary influence on the copper-cylinder, which however is for itself not sufficient to set the same in rotation, but sufficient to neutralize the influence of the friction at a slow rate of speed. The same object can also be attained by giving to the poles of the shunt electro-magnet directly a non-symmetrical shape, or by arranging the same so as to be somewhat shiftable, so that they for instance can be slightly turned or shifted into a non-symmetrical position toward the copper-cylinder and armature; or lastly, armature located within the copper cylinder may be made axially movable so that it can be shifted somewhat out of alignment with the pole-ends of the shunt electro-magnet, as shown in dotted lines in Fig. 1. The coils of the main electro-magnet are guided in dove-tailed ways, as shown in Fig. 2, so that they can be adjusted on the base-plate of the apparatus, and set closer to or farther away from the rotary metallic cylinder, whereby the constant coefficient of the apparatus can be varied to some extent, respectively made to one. It is furthermore obvious that each electro-magnet may be replaced by several electro-magnets of equivalent effect.

What I claim is—

1. In alternating-current meters, the combination of a shunt electro-magnet arranged in parallel circuit with the lamps, an armature arranged between and in line with the pole-ends of said shunt electro-magnet, a rotary metallic cylinder inclosing the armature,

and a main electro-magnet within whose field the cylinder and its inclosed armature are located, said field intersecting the field of the shunt-magnet, and said main electro-magnet being arranged at such a distance from the armature that the phase-movement between the two fields is as great as possible, the interval of proportionality between the current and velocity being within broad limits and the damping by Foucault's-currents rendered very effective and independent of the main-current, substantially as set forth.

2. The combination of a main electro-magnet, a shunt electro-magnet, whose field is intersected by the field of the main electro-magnet, an armature located between and in line with the pole-ends of the shunt-magnet, a rotary metallic cylinder inclosing the armature, and means, substantially as described, whereby the magnetic field of the shunt electro-magnet is rendered unsymmetrical, and the latter alone enabled to exert a small rotary momentum on the rotary cylinder, substantially as set forth.

3. The combination of a main electro-magnet, a shunt electro-magnet whose field is intersected by the field of the main electro-magnet, an armature located between and in line with the pole-ends of the shunt-magnet, a rotary metallic cylinder inclosing the armature, and adjustable pole-plates arranged at one side of the pole-ends of the shunt-magnet, so as to render the magnetic field of the latter non-symmetrical, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

THEODOR BRUGER.

Witnesses:

JEAN GRUND,
FRANK H. MASON.