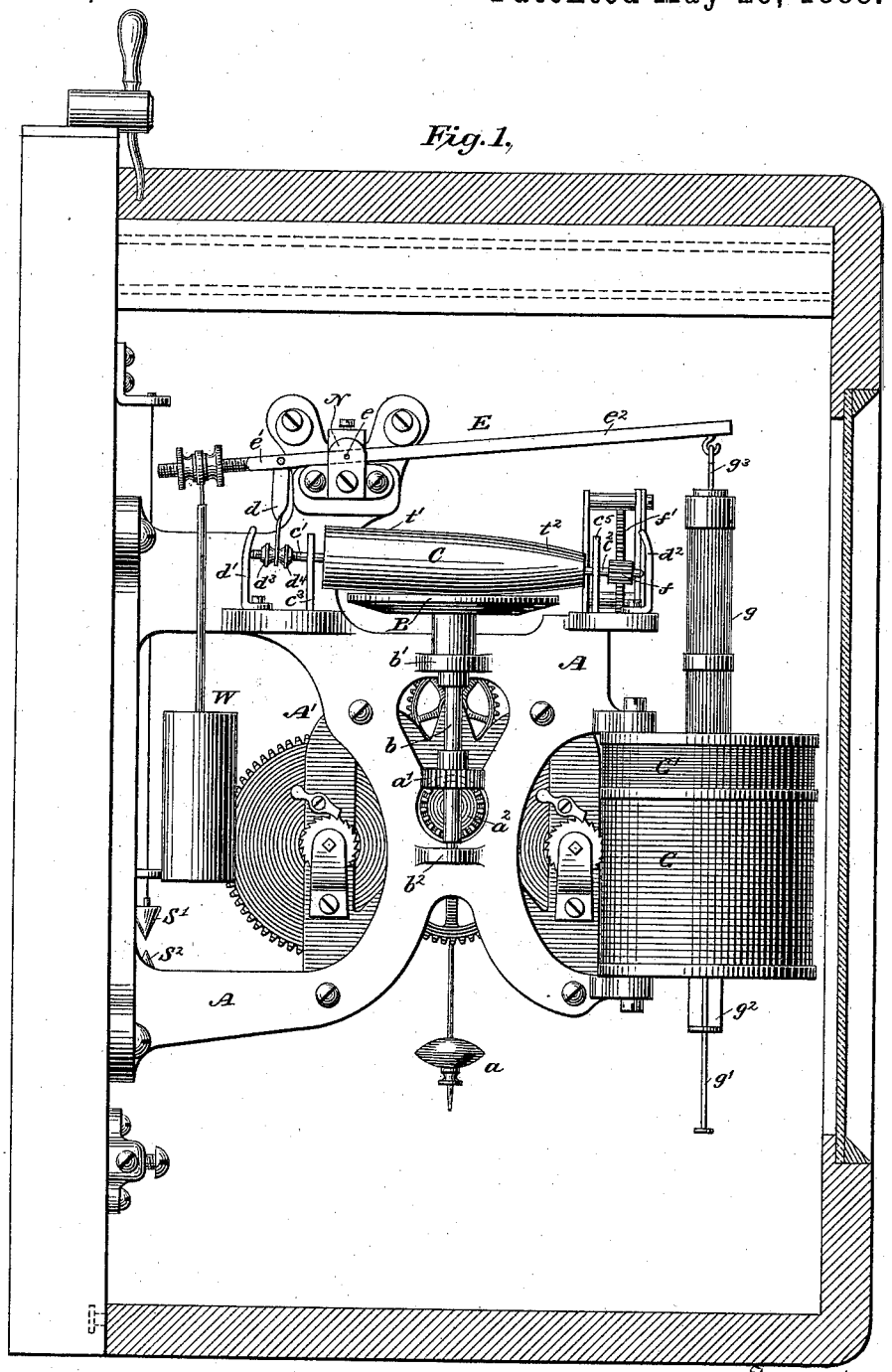
(No Model.) 2 Sheets—Sheet 1.

G. WESTINGHOUSE, Jr., & P. LANGE.

ELECTRIC METER.

No. 383,680. Patented May 29, 1888.

Fig. 1.



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

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ELECTRIC METER.

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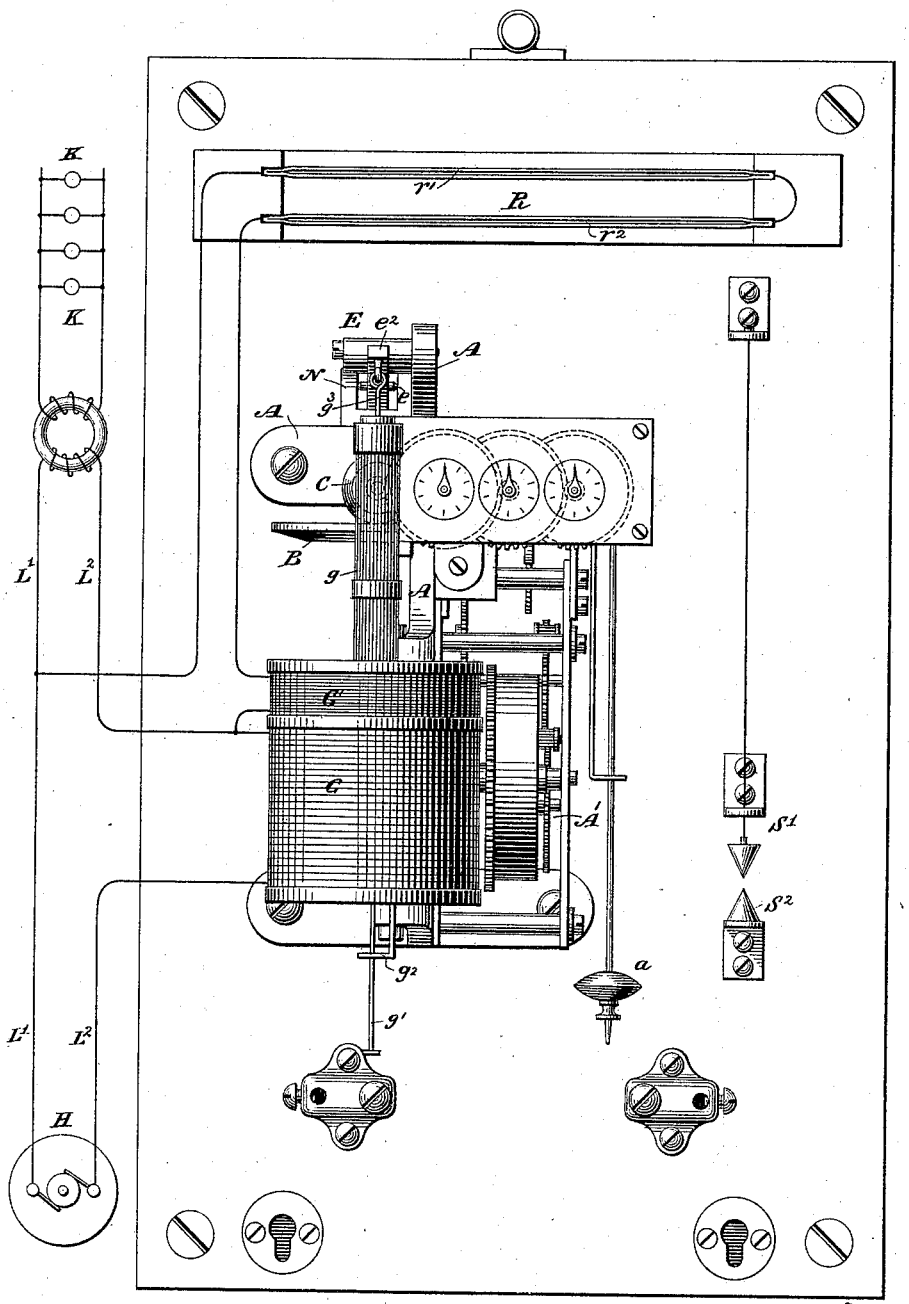
Fig. 2.



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UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., AND PHILIP LANGE, OF PITTSBURG, PENNSYLVANIA, ASSIGNORS TO THE WESTINGHOUSE ELECTRIC COMPANY, OF SAME PLACE.

ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 383,680, dated May 29, 1888.

Application filed October 29, 1887. Serial No. 253,693. (No model.)

To all whom it may concern:

Be it known that we, GEORGE WESTINGHOUSE, Jr., and PHILIP LANGE, citizens of the United States, residing in Pittsburg, in the county of Allegheny, in the State of Pennsylvania, have invented certain new and useful Improvements in Electric Meters, of which the following is a specification.

The invention relates to apparatus employed for registering the quantity of electricity used for operating translating devices or consumed in any given circuit.

The invention involves certain details and improvements upon the meter described in an application for Letters Patent filed by George Westinghouse, Jr., June 16, 1887, Serial No. 241,459.

In carrying out the invention a disk or circular plane or a curved surface is employed as the actuating-surface. This is revolved at a determinate and uniform speed. Against its face there rests a roller having in this instance the general form of a prolate spheroid. The periphery of this roller is in frictional contact with the face of the disk or revolving surface. The point of contact is varied by the action of appropriate mechanism, and is more or less distant from the center of the disk as the current traversing the apparatus is increased or diminished. The consequent movement of the roller depends for its rate upon the distance of the point of contact from the center of the revolving surface. It is further dependent upon the circumferential measurement or the diameter of the roller in the plane of its point of contact. The revolutions of the roller are communicated to appropriate registering devices, which serve to show at any time the quantity of electricity which is traversing the apparatus.

The present invention involves certain details in the general organization of parts and their construction.

In the accompanying drawings, Figure 1 is a side elevation, and Fig. 2 a front view, of the apparatus.

Referring to the figures, A represents a frame for carrying the various parts of the mechanism. In this frame there is placed a chronometric movement of any suitable character, as indicated at A'. This is adapted to revolve a disk, B, upon its axis, b, at a determinate and uniform rate of speed. This rate may be controlled by a pendulum, a, serving to govern the escapement of the clock-movement. The axis b is carried in suitable lugs, b' b^2, upon the frame A. A pinion, a', gears with a wheel, a^2, driven by the clock-train.

A roller, C, carried upon an axis, c' c^2, bears against the face of the disk B. One end, t^2, of this roller is turned off so as to have a curved longitudinal section. The other end, t', of the roller may be approximately straight, if desired, since the portion t^2 alone is used as a contact-surface. The roller is so mounted that when it rests upon the center of the disk B the axis c' c^2 will be sufficiently inclined to prevent the end t' from touching the disk. One end, c', of the axis is mounted in a stirrup, d, depending from the shorter arm, e', of a lever, E. This stirrup is held between two adjustable nuts, d^3 and d^4, turning upon the axis. By means of these the relative movement communicated to the roller from the lever may be adjusted. The end c' of the axis passes between vertical guides c^3, (one only of which is shown,) and is capable of vertical but not of lateral movement. The other end, c^2, of the axis passes between similar guides, c^5.

Two upright plates, d' and d^2, are placed at the respective ends of the axis, being carried upon the frame A. These serve to prevent undue longitudinal movement of the roller. They are curved to correspond with the arcs described by the ends of the axis c' c^2 when it rocks upon the disk B.

It will be evident that when the axis of the roller C is in the position shown, its greatest diameter being coincident with the center of the disk B, no movement will be communicated to it by the revolution of the disk. If, however, the end c' be raised and the end c^2 be lowered, the points of contact, both upon the disk and upon the roller, will be changed, and

the latter will revolve at a speed dependent upon the two factors—namely, the distance from the center of revolution of the disk to the point of contact and upon the circumference of the roller at its point of contact. This last factor may be varied to suit the requirements of individual cases by varying the proportions of the section of an ellipse which forms the longitudinal section of the roller. The rate of revolution will be proportionately greater as the circumference at the point of contact becomes less, and vice versa.

The motion of the roller C is communicated to a counting, indicating, or registering mechanism of any suitable character or of any well-known construction. This may be effected through the instrumentality of a pinion, *f*, upon the portion c^2 of the axis of the roller. This pinion engages a toothed wheel, *f'*, of the indicating mechanism. The engagement of the pinion *f* with the wheel is such that the movements arising from the rocking of the roller C will not interfere with the proper transmission of the motion, and it is for this purpose preferably so placed that its movement is tangent to the wheel, as shown. This pinion is placed between the plate d^2 and the guides c^5, though the latter might be placed upon the opposite side of the pinion.

In order to shift the point of contact between the roller C and the disk B, so that its position will bear a definite relation to the strength of current which is being measured, a coil or solenoid, G, of thick conducting-wire, is included in the circuit of the generator or other source of supply, as indicated at H. For instance, a conductor, L^2, may lead from one pole of the source through the coil G to the work-circuit K K. The current flowing to the circuit will necessarily traverse the coil G. A core, *g*, preferably composed of a bundle of soft-iron wires insulated from each other, extends axially into the coil G, and this will be drawn a greater or less distance into the coil in a manner well understood, according to the strength or volume of the current which is passing through to supply the work-circuit K K. A guide-rod, *g'*, at the end of the core passes through a guide-plate, g^2, at the bottom of the coil. A supplementary coil, G', of thin insulated wire, having a large number of turns, may be connected across from the conductor L' to the return-conductor L^2, and this coil also acts upon the core *g*.

The core *g* is suspended by a link, g^3, from one arm, e^2, of the pivoted lever E, in such manner that as it is drawn farther into the coils the lever will turn upon its fulcrum *e*, and thus raise the opposite end, *c'*, of the axis of the roller C against the action of a suitable adjustable counterpoise, W, applied to the arm *e'* of the lever. Hence it will be understood that the angular position of the axis of the roller C depends upon the value of the current traversing the apparatus, and the rate of revolution of the roller C will be determined by its position with reference to the center of revolution of the disk B.

The several parts are so adjusted that when no current is being consumed in the work-circuit the roller C will bear directly against the center of revolution of the disk B, and consequently no motion will be communicated thereto and the registering device will remain at rest.

The fulcrum *e* of the lever E is carried in a suitable bracket, N, extending from the frame A.

An artificial resistance, R, is preferably placed in the circuit of the conductor leading through the coil G', for reducing the current to such extent as may be necessary or desirable. This resistance may be conveniently made in the form of one or more flat series of wires, as shown at r' r^2, and placed at the upper portion of the instrument. The heat which is developed therein by the current may be utilized for keeping the apparatus at approximately constant normal temperature, and thus rendering its operation more exact.

A plummet, S', hanging above an indicator, S^2, is employed for assisting in placing the instrument in position.

It should be noticed that the clock-movement will actuate the disk B at a rate dependent upon the length of the pendulum *a*, and that this can be adjusted so as to regulate all the meters to be employed in a system to any required constant.

We claim as our invention—

1. In an electric meter, the combination of a friction-roller, a revolving disk against the face of which the roller rests, registering mechanism receiving motion through said roller, and means for automatically modifying the angle of the axis of said roller with reference to the surface of the disk in accordance with variations in the force to be measured, said roller being of gradually-diminishing cross-section through the portion adjacent to the center of the revolving surface and one end and approximately straight through its remaining portion.

2. In an electric meter, the combination, with a flat revolving surface, of the roller in frictional contact therewith, said roller being of gradually-diminishing cross-section from the center to one end, a lever operated by variations in the current, a stirrup connecting one arm of said lever with the axis of said roller, the point of attachment with the axis being adjustable, a registering device, and a pinion carried by said axis and communicating motion to the registering device.

3. In an electric meter, the combination of the clock-movement, the revolving disk B, the roller C, resting thereon, and the curved plates d' d^2 at the respective ends of the axis of said roller for preventing it from undue longitudinal movement, substantially as described.

4. In an electric meter, the combination,

with the rocking roller C and the revolving disk B, upon which the roller rests, of the axis for said roller, the guide-plates at the respective ends of the axis, a pinion upon said axis between the rollers and one of said guide-plates, and a registering mechanism geared with said pinion.

In testimony whereof we have hereunto subscribed our names this 18th day of October, A. D. 1887.

GEO. WESTINGHOUSE, JR.
PHILIP LANGE.

Witnesses:
W. D. UPTEGRAFF,
DANL. W. EDGECOMB.