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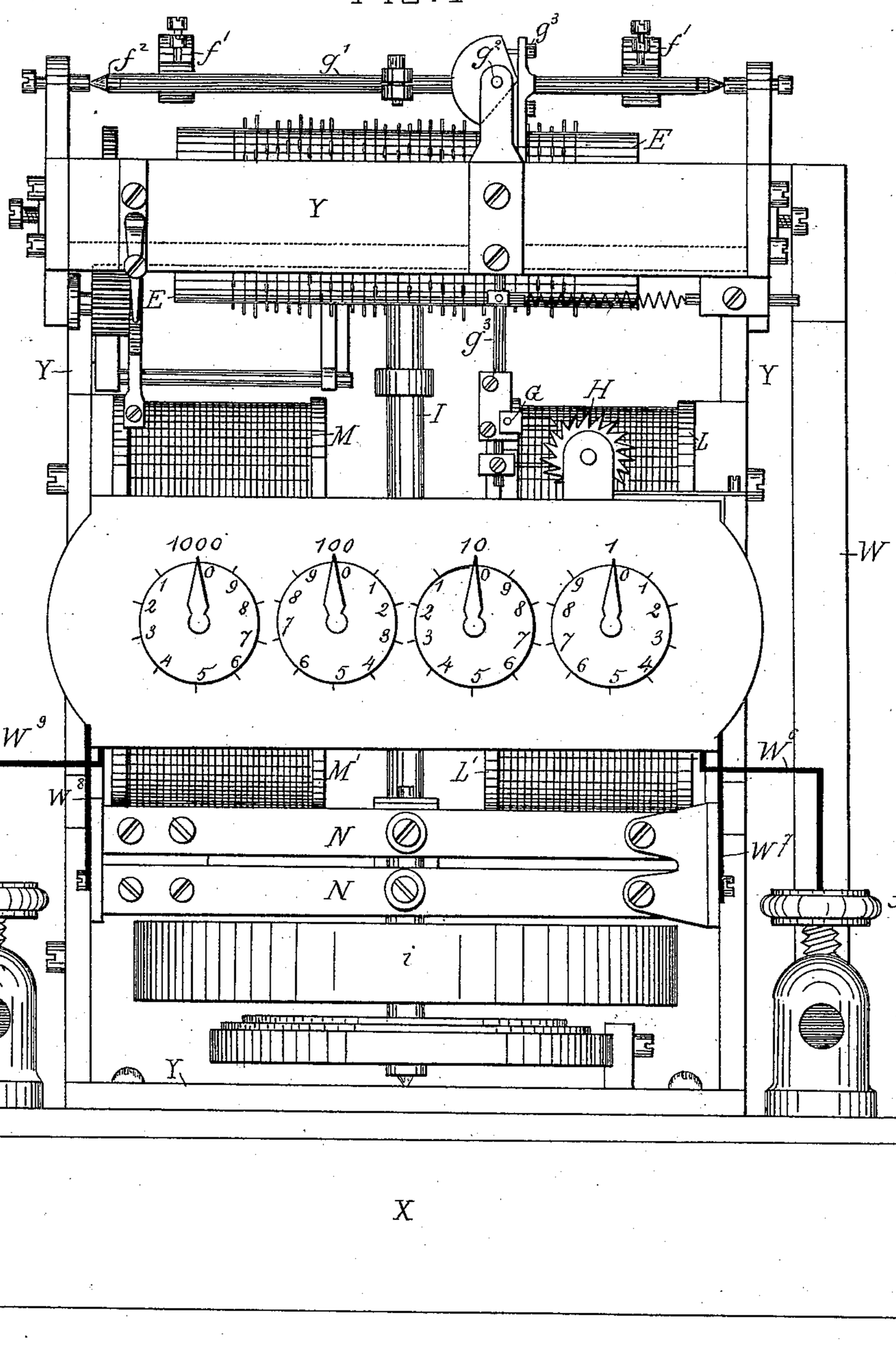
J. CAUDERAY.

ELECTRIC DYNAMOMETER.

No. 372,358. Patented Nov. 1, 1887.

FIG. 1



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Walter S. Dodge.

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N. PETERS. Photo-Lithographer, Washington, D. C.

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FIG 2

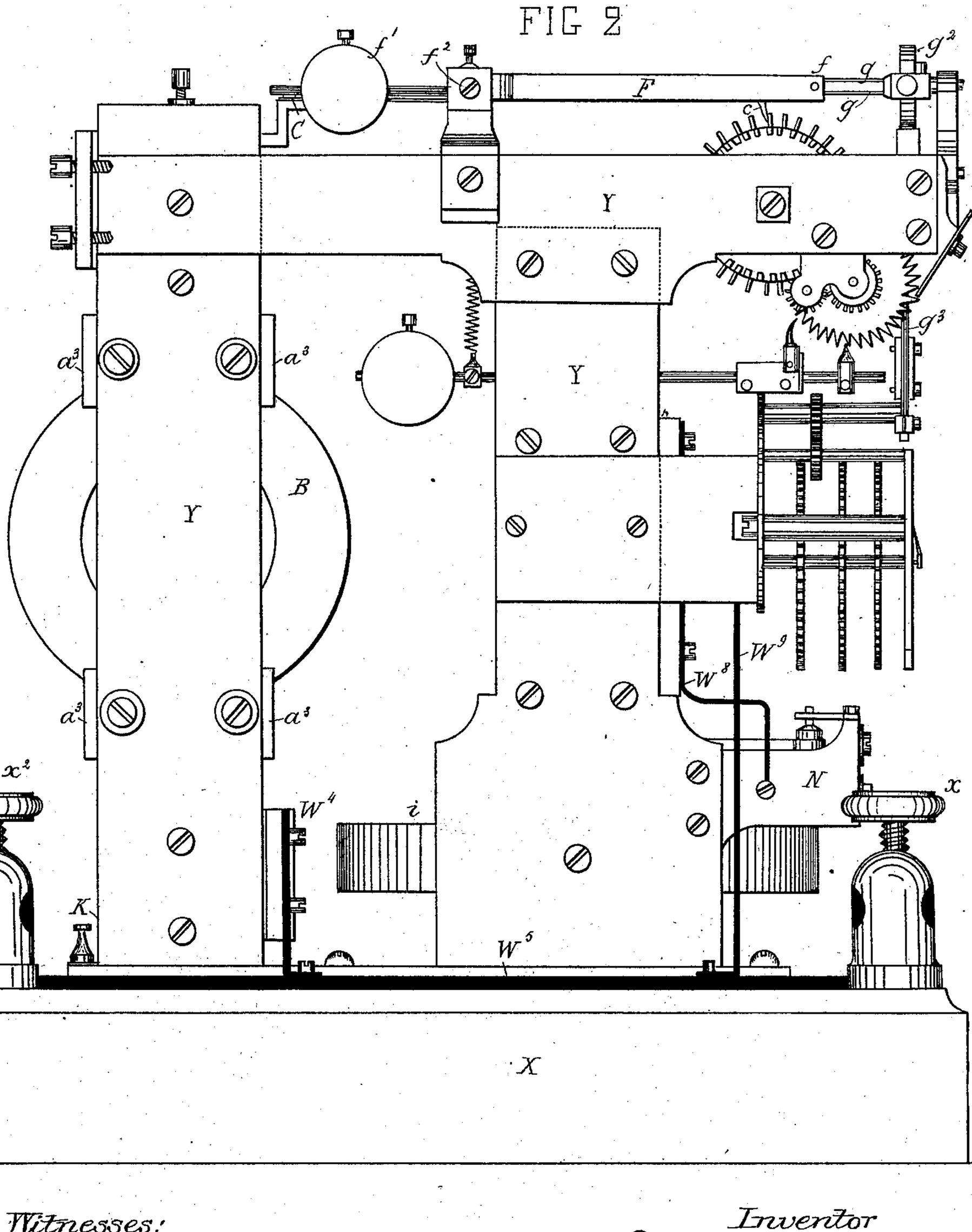

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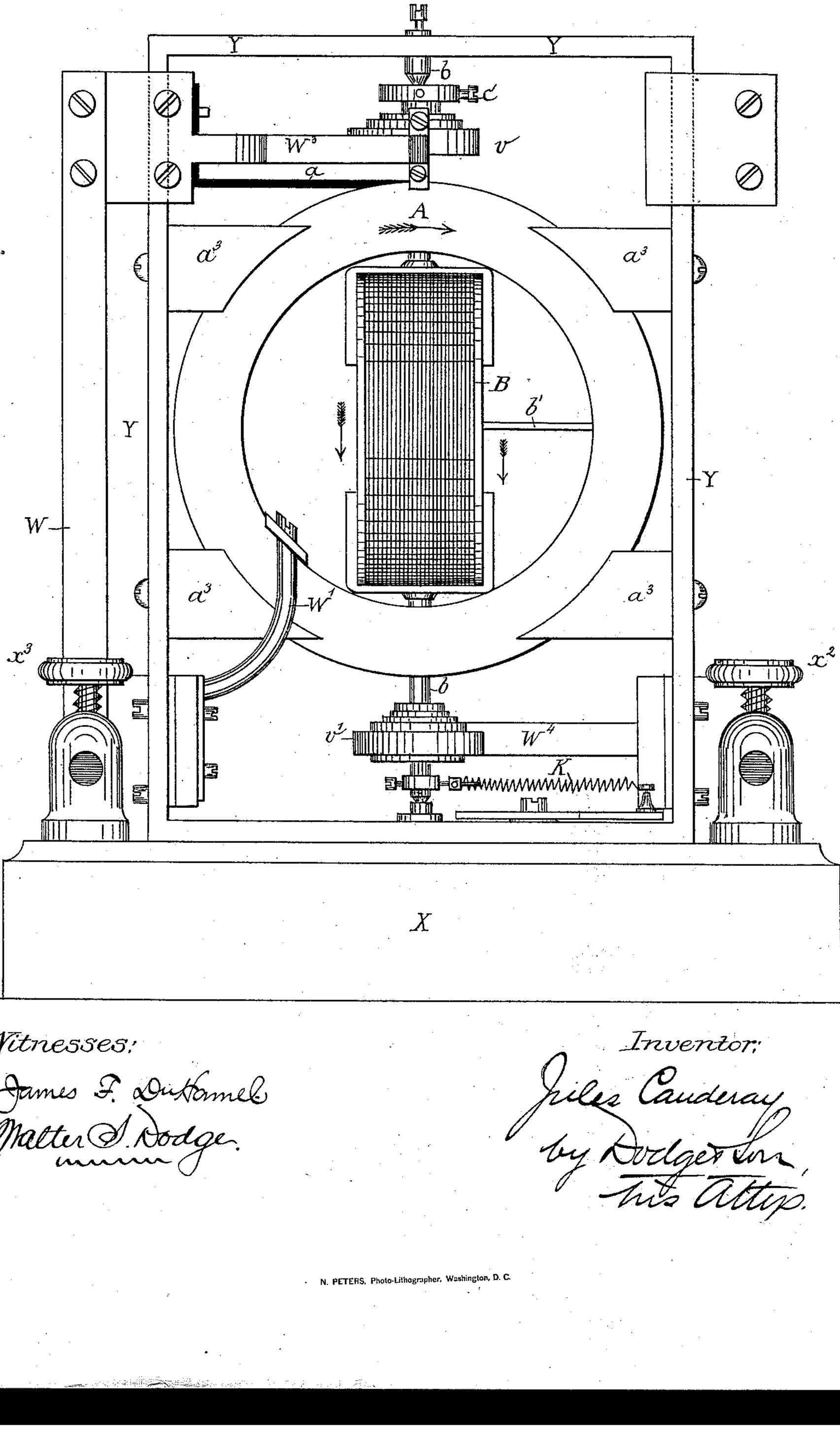
FIG. 3



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(No Model.) 6 Sheets—Sheet 4.

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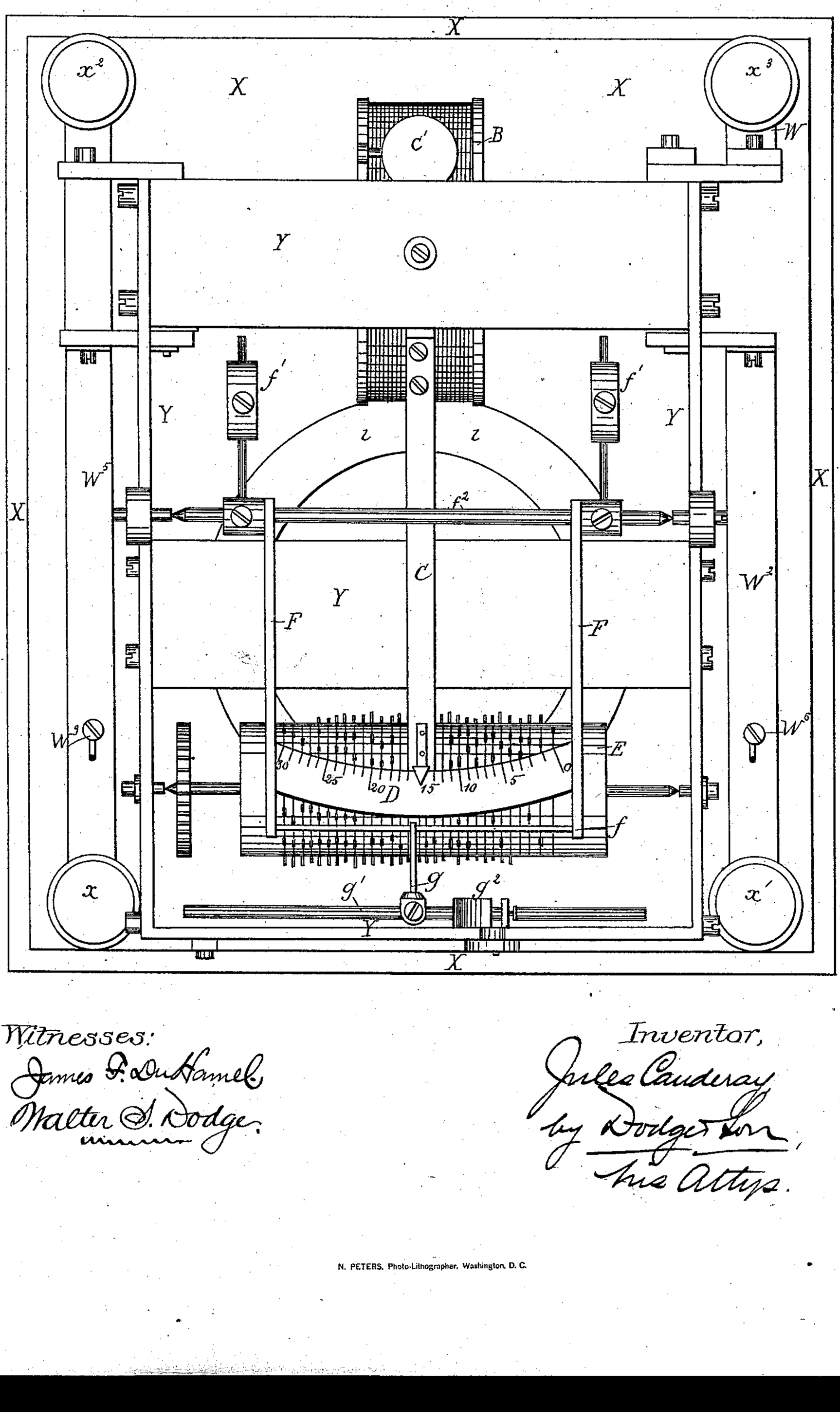
FIG. 4



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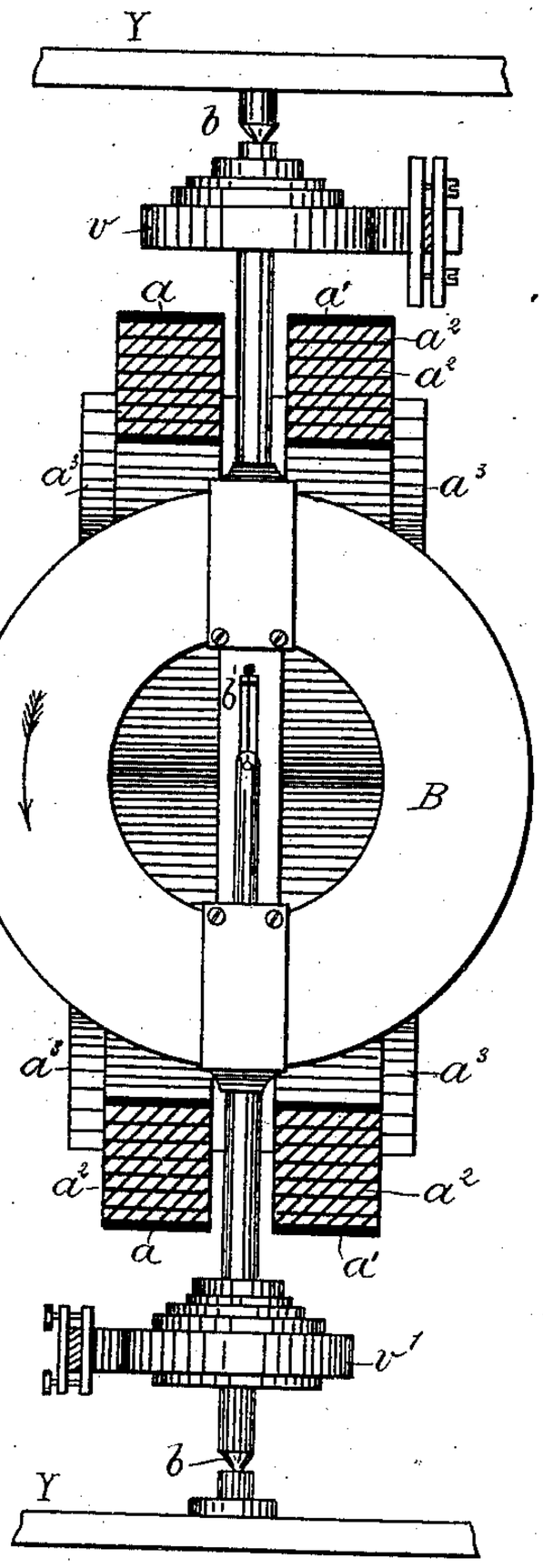
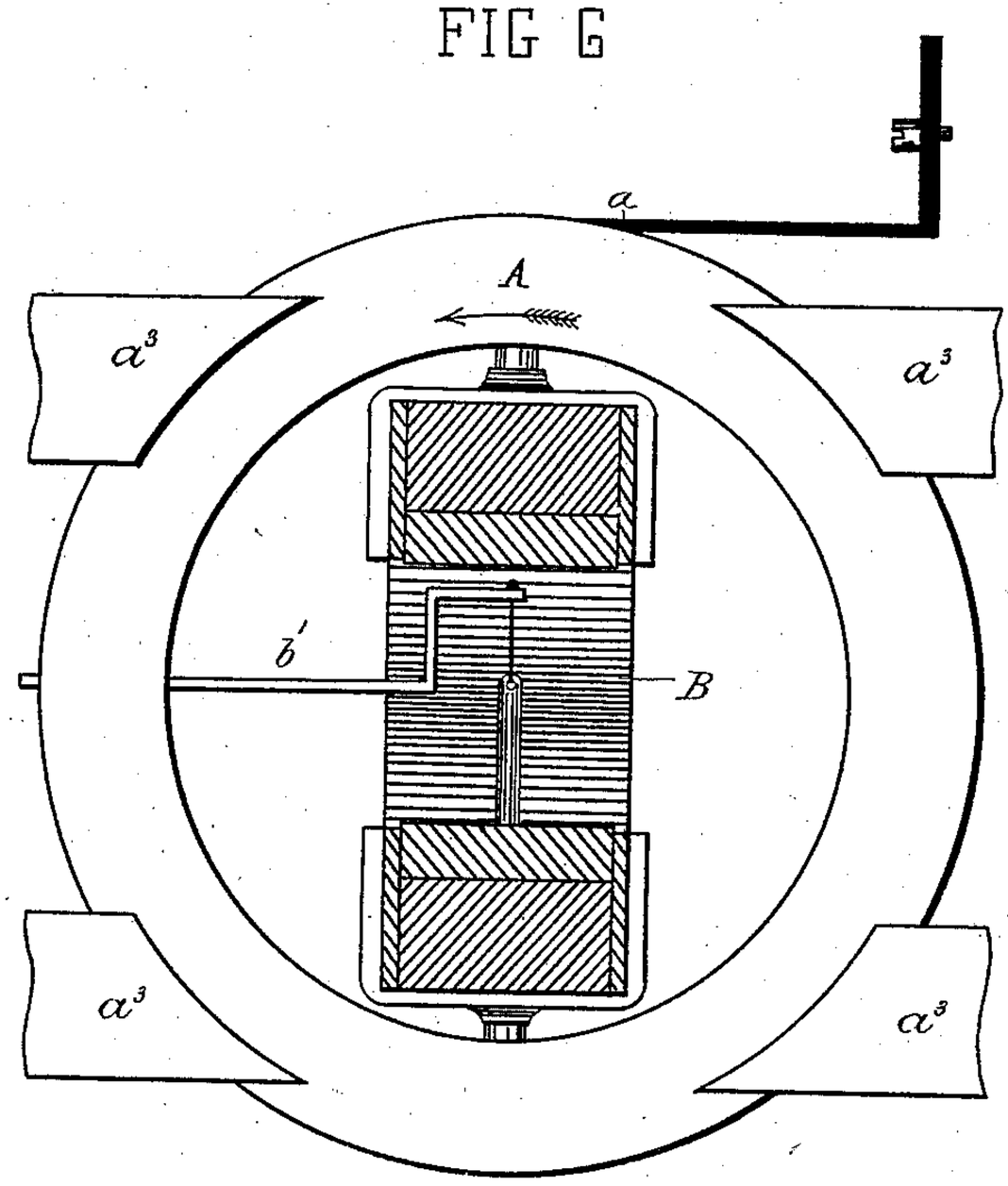


FIG 5

FIG 6



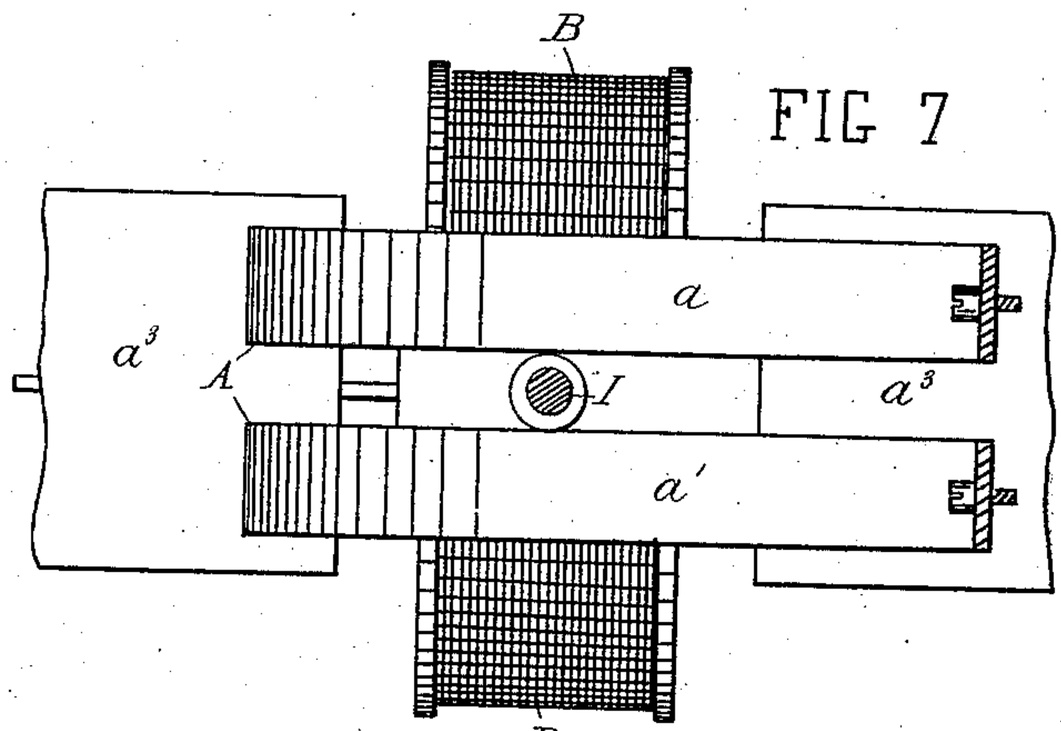


FIG 7

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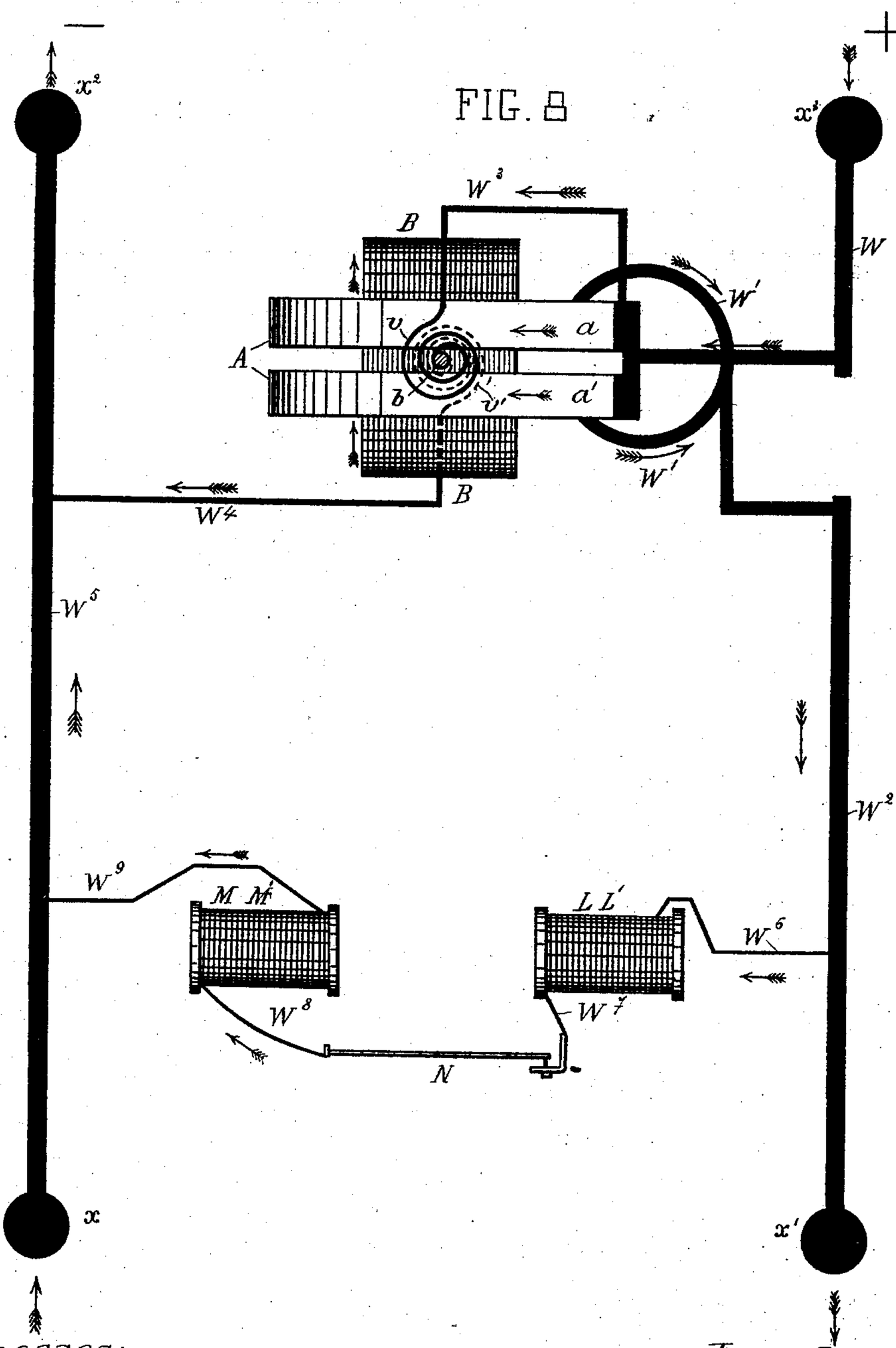
ELECTRIC DYNAMOMETER.

No. 372,358. Patented Nov. 1, 1887.

FIG. 8



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Inventor;
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UNITED STATES PATENT OFFICE.

JULES CAUDERAY, OF PARIS, FRANCE.

ELECTRIC DYNAMOMETER.

SPECIFICATION forming part of Letters Patent No. 372,358, dated November 1, 1887.

Application filed January 29, 1887. Serial No. 225,926. (No model.) Patented in France November 15, 1886, No. 179,657.

To all whom it may concern:

Be it known that I, JULES CAUDERAY, a citizen of Switzerland, residing at Paris, Avenue Laumière 1, France, have invented certain new and useful Improvements in Electric Dynamometers, (for which I have received Letters Patent of France No. 179,657, dated November 15, 1886;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The object of this invention is to devise an apparatus for measuring the electrical energy of any given current.

To find the energy of a current it was heretofore always necessary to determine by computation the product of the electro-motive force and the intensity of the current; in other words, to multiply the number of volts into the number of ampères per second, the product being expressed in watts or units of energy.

My new electric meter (for which I have procured Letters Patent of France, dated the 15th day of November, 1886, and numbered 179,657) directly indicates the number of watts of any electrical current into the circuit of which it is introduced without necessitating any calculation.

This meter consists of the following parts: First, an electro-dynamometer of particular construction; second, a clock-work for regulating the time; third, a toothed cylinder making one revolution per minute, of the same construction as in my previous patents, No. 310,252, dated January 6, 1885, and No. 218,166, dated May 19, 1885; fourth, a registering apparatus with dial-plates.

The registering of the number of watts is effected as the registering of the current in my previous patents—viz., by means of an oscillating index or pointer actuated by the electro-dynamometer. The greater or less deflection of this pointer—the end of which is in close proximity to the toothed cylinder which maintains a regular and continuous rotary motion representing the unit of time—produces a corresponding number of contacts which set a ratchet-wheel in motion. This wheel transmits the motion to a series of registering-wheels.

The accompanying drawings give a correct and complete representation of the apparatus.

Figure 1 is a front elevation of the meter. Fig. 2 is a side elevation. Fig. 3 is a back view. Fig. 4 is a plan or top view. Figs. 5, 6, 7 are detail views of the electro-dynamometer. Fig. 5 shows the fixed outer bobbin, A, in cross-section and the moving bobbin B in side elevation. Fig. 6 shows the fixed bobbin in a side view and bobbin B in section. Fig. 7 is a plan view of the two bobbins. Fig. 8 is a diagrammatic representation of the course of the current through the apparatus.

The figures are drawn on the actual scale of execution. The arrows indicate the direction of the current.

The various parts of the apparatus are mounted on a solid frame, Y, fixed to a foot-plate, X.

The electro-dynamometer consists of two ring-shaped bobbins, A and B, as shown in Figs. 3, 5, 6, and 7. The outer bobbin, A, is kept in place by means of four grooved wooden blocks, a^3, screwed to the frame. This bobbin A is composed of two perfectly identical parallel rings, a a', Figs. 5 and 7, connected with each other and traversed by parallel currents. Each one of these rings is formed of a conductor of flat wire ribbon of a cross-section proportional to the maximum intensity of the current to be measured. This conductor is wound on itself for as great a length as may be needed. It is seen in section in Fig. 5. The different spirals are insulated from each other by means of strips of cloth a^2, or in any other suitable manner. The main current enters each of these conductors at its upper extremity, where it is connected with the copper piece W^3, as shown in Figs. 3 and 8, which is fixed to but insulated from the frame Y and connects with the binding-post x^3. At the lower extremities the same current leaves the two conductors and passes into the piece W′, which connects with the binding-post x'. The inner bobbin, B, is movable. It is placed inside the bobbin A, so that the geometrical centers of the two bobbins coincide. It consists of a single wooden ring or core, on which is wound a very long fine wire offering an electrical resistance of about a thousand ohms. This wire receives

a branch derived from the current to be measured. This bobbin is pivoted at *b b*, at the top and at the bottom, resting with its vertical trunnions in two bearings, which are adjustably attached to the frame of the machine, as shown in Figs. 3 and 5. To secure its independence and sensibility, the bobbin is at its center suspended from a silk thread attached to a flexible arm, *b'*, as shown in Figs. 5 and 6. The top of the upper trunnion of bobbin B carries a pointer, C, Fig. 4, which follows the oscillations of bobbin B, produced by the passage of the current, and indicates their amount by pointing with the index at its end to the divisions of the dial-plate D. This pointer C, the operation of which will be found fully described in my previous patents, carries at its end, below the dial-plate D, a wedge-shaped brass piece, *c*, Fig. 2. Whenever this wedge *c* strikes one of the teeth of the cylinder E, it will raise the movable frame F that carries the dial-plate D. The outer cross-bar, *f*, of the movable frame F passes between the two branches of a fork, *g*, and thus communicates its oscillations to the rod *g'*, which pivots about a shaft, g^2, projecting from the fixed frame of the machine. On the other side of the pivot g^2 the rod *g'* carries a vertical rod, g^3, provided at its lower end with a catch, G, which meshes with the teeth of the ratchet-wheel H. This wheel H drives the wheels of the registering apparatus, which operates in the well-known manner. Here, as in my previous patents, the clock-work is driven by electricity. To this end four fixed coils are used. The oscillations of the armature produced by the passage of the current through the coils is directly communicated to the shaft I and its balance-wheel *i*, and their motion is transmitted to the toothed cylinder E, which thus has its motion regulated at the rate of one revolution per minute. The mechanical construction and disposition of this cylinder are identical with that described in my former patents.

As long as the apparatus is at rest the pointer C is kept at the zero of the scale or dial-plate by means of the adjustable spring K, acting on the lower trunnion, *b*, of the movable bobbin B, as shown in Fig. 3.

c' is an adjustable counterpoise of the pointer C, and *f' f'* are similarly-adjustable counterpoises of the movable frame F, carrying the scale and pivoting on f^2 as axis.

The wooden foot-plate X is furnished with four binding-posts, *x x'* x^2 x^3. Their use will be explained hereinafter.

The diagram, Fig. 8, shows the course of the current in the various parts of the apparatus. Entering at binding-post x^3, the current passes through the large conducting-piece W into the ribbon-shaped conductors *a a'*, forming the coil A. The current completely traverses these two annular conductors, each in the same direction as the other. It then passes through conductors W' W' to the large conductor W^2, which leads to binding-post *x'*. From this post the current goes to the lamps or other translating device, and again enters the apparatus at binding-post *x*, whence it returns by way of binding-post x^2 to the source of electricity. The inner movable coil, B, receives the current through the conductor W^3, carrying a spiral spring, *v*, to which one of the ends of the fine wire of the movable coil is attached. The conductor W^3 connects with the large conductor W. After passing through coil B the current leaves it through the lower spiral, *v'*, attached to the conducting-arm W^4, which again connects with the large conductor W^5. Under the action of the current the bobbin B oscillates, owing to the well-known law of direct attraction and repulsion of currents against each other.

The two springs *v* and *v'* serve to allow the current to enter and leave without affecting the free movement of the bobbin B. This arrangement, however, has been described and illustrated in one of my former patents.

This electro-dynamometer, as invented by me, is constructed according to the principle of Weber's electro-dynamometer.

The clock-work is driven by a derived current. A conductor, W^6, branching off from the large conductor W^2, leads the current to the upper coil, L. It passes through this coil, then through coil L', placed below the former, as shown in Figs. 1 and 8, and is then conducted through conductor W^7 to the automatic break-circuit N, or regulating mechanism, described in my previous patents. From there the current passes through conductor W^8 into the two coils M M', whence it goes through conductor W^9 to the large conductor W^5.

It is to be noticed that in my previous meters the regulating mechanism of the balance consisted of a single flat spring provided with a tangent screw and a small arm moving in a notch of the beam or shaft of the armature. In the present apparatus I use the same arrangement twice, in order to secure a better working of the meter.

I do not wish to be restricted exactly to all the details of execution as above set forth; nor do I intend to always combine the two parts of the apparatus, since my electro-dynamometer may be used separately or be adapted to a registering apparatus of a different pattern; but

I claim as my invention—

1. The herein-described dynamometer, consisting of an annular coil, A, fixed in position and composed of two like spiral coils of metallic-ribbon conductor of a cross-section proportionate to the maximum intensity of the current to be measured, and a second annular coil wound with a long fine wire and suspended and free to turn within the first annular coil.

2. The combination of the dynamometer, consisting of annular coils A B, one fixed and the other mounted and arranged to turn therein, and provided with a catch or dog, an arm carried by the movable coil, a toothed cylin-

der beneath said arm, a motor connected with and serving to rotate said cylinder, a balance-wheel applied to said motor to regulate the speed of the motor and toothed cylinder, and a register actuated by the catch or dog of the arm carried by the movable coil of the dynamometer.

In testimony whereof I affix my signature in presence of two witnesses.

JULES CAUDERAY.

Witnesses:
G. DE MESTRAL,
ROBT. M. HOOPER.