

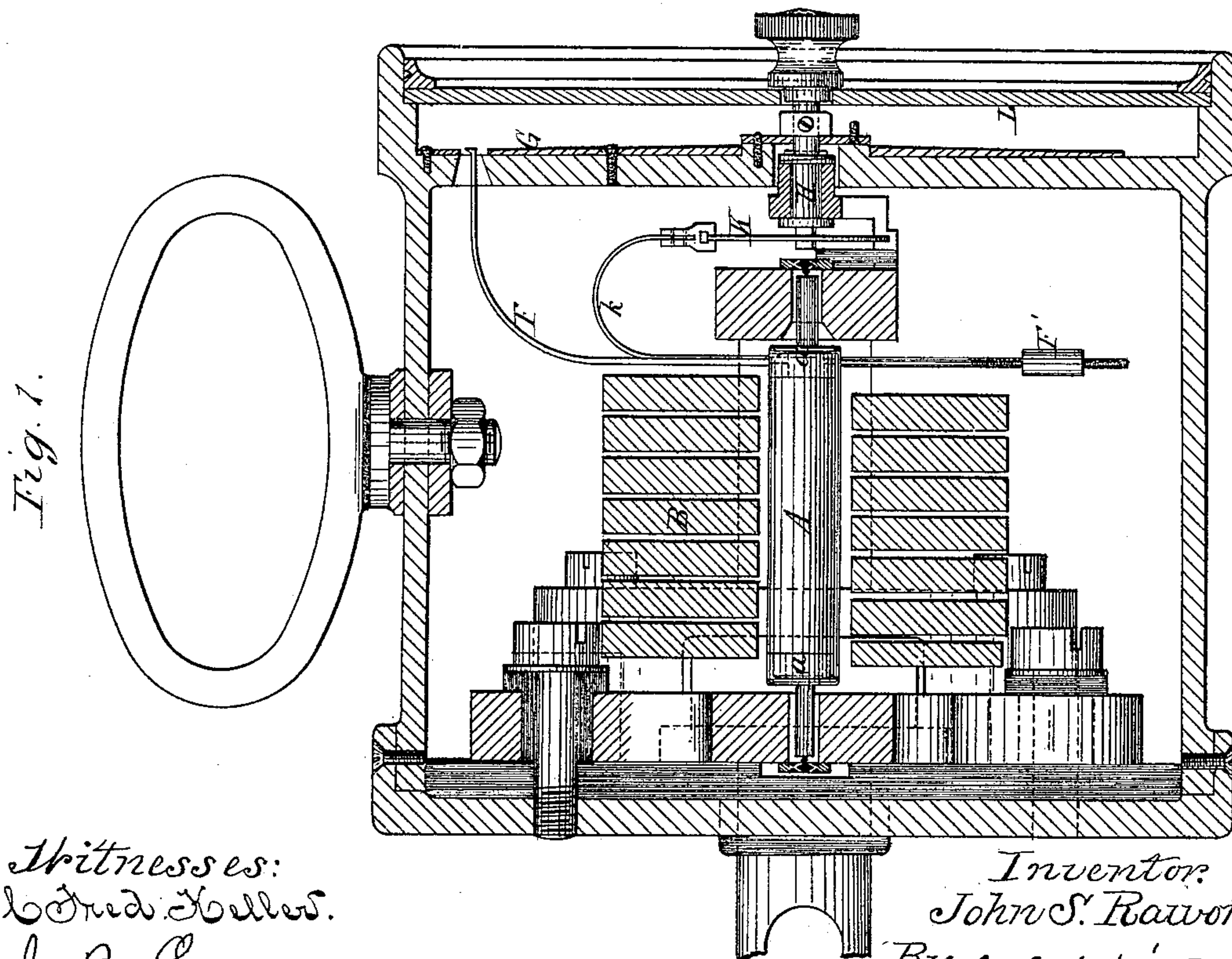
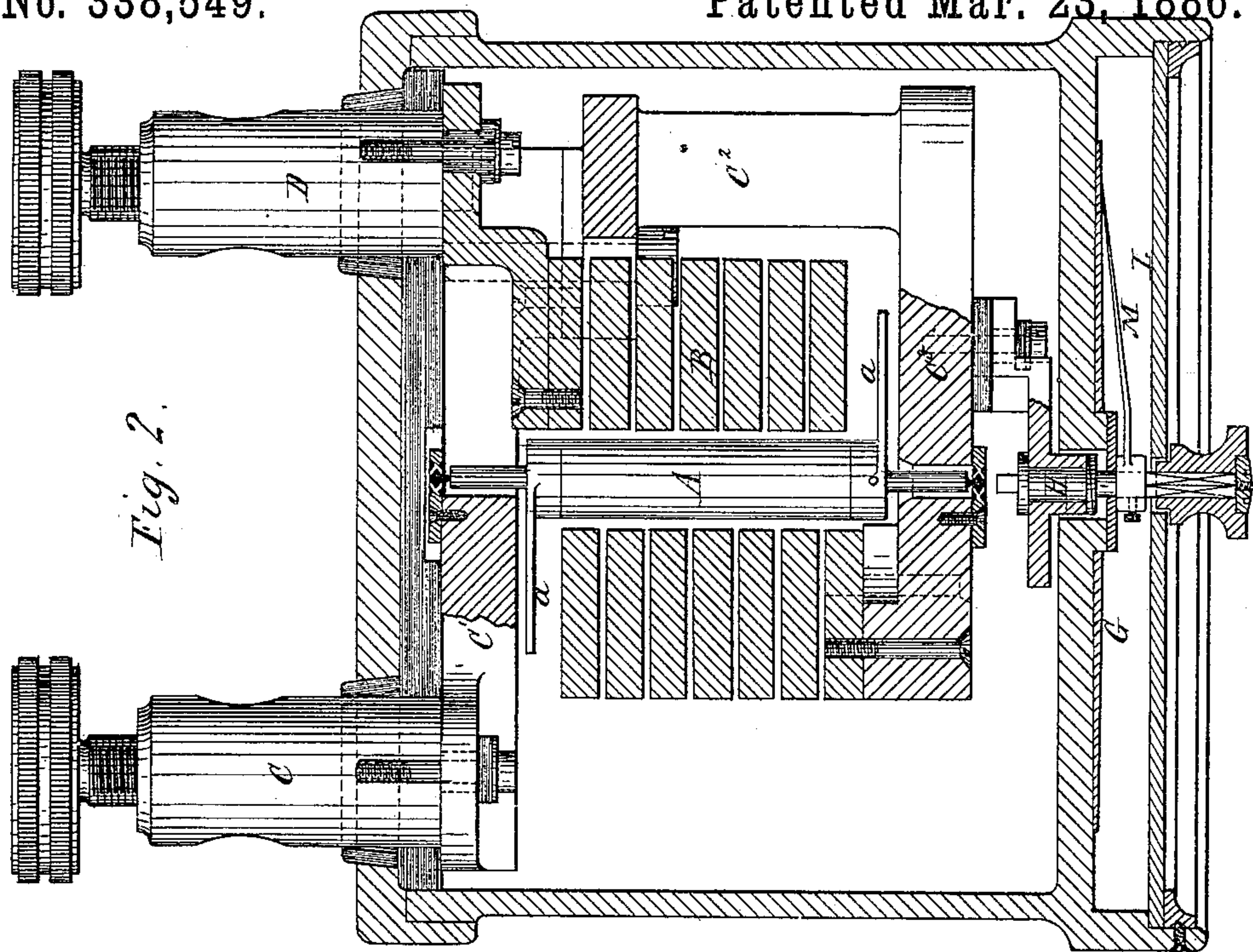
(No Model.)

3 Sheets—Sheet 1.

J. S. RAWORTH.
ELECTRIC METER.

No. 338,549.

Patented Mar. 23, 1886.



Witnesses:
Edw. Heller.
J. B. Lawyer

Inventor:
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(No Model.)

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Fig. 6.

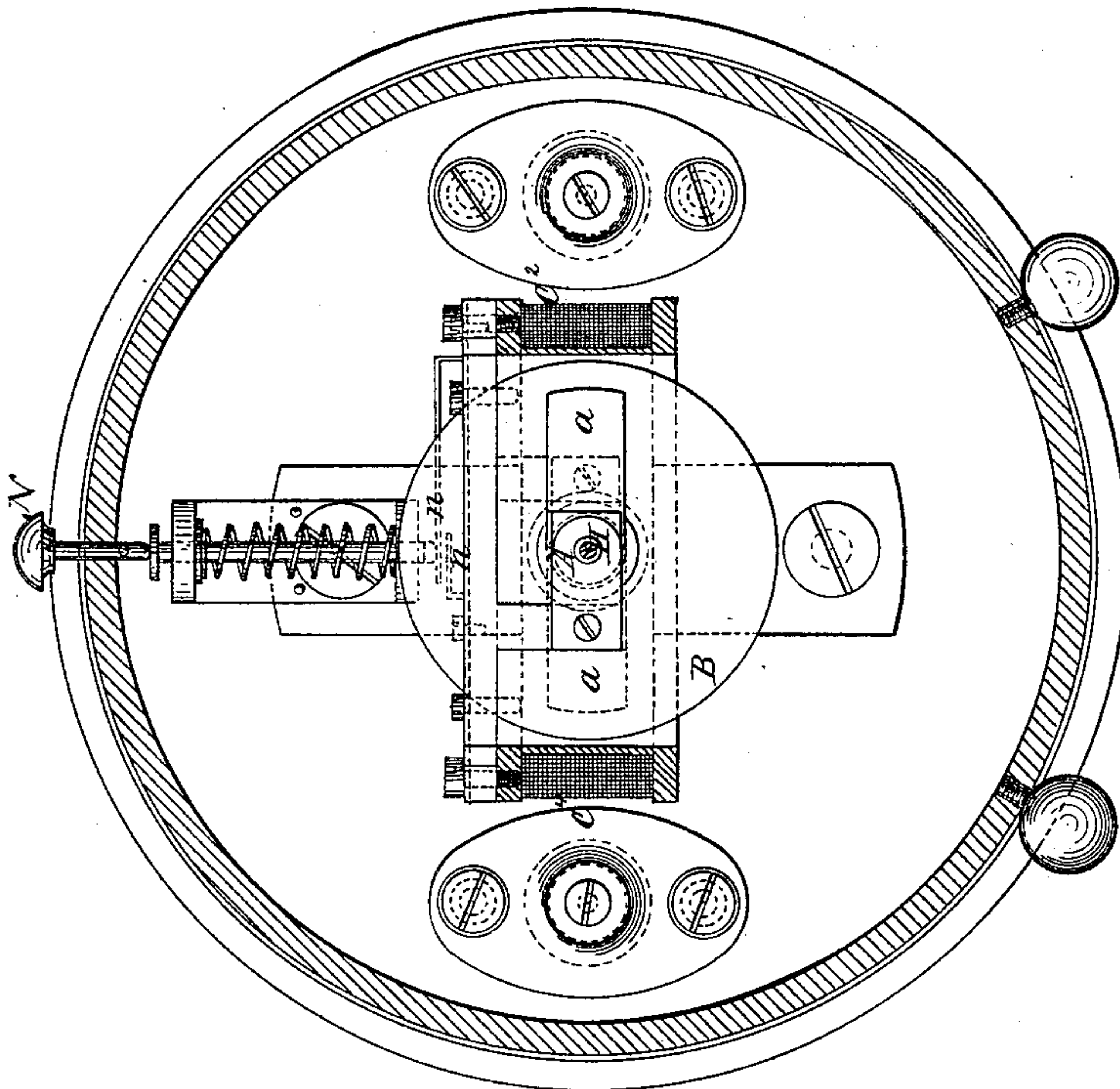
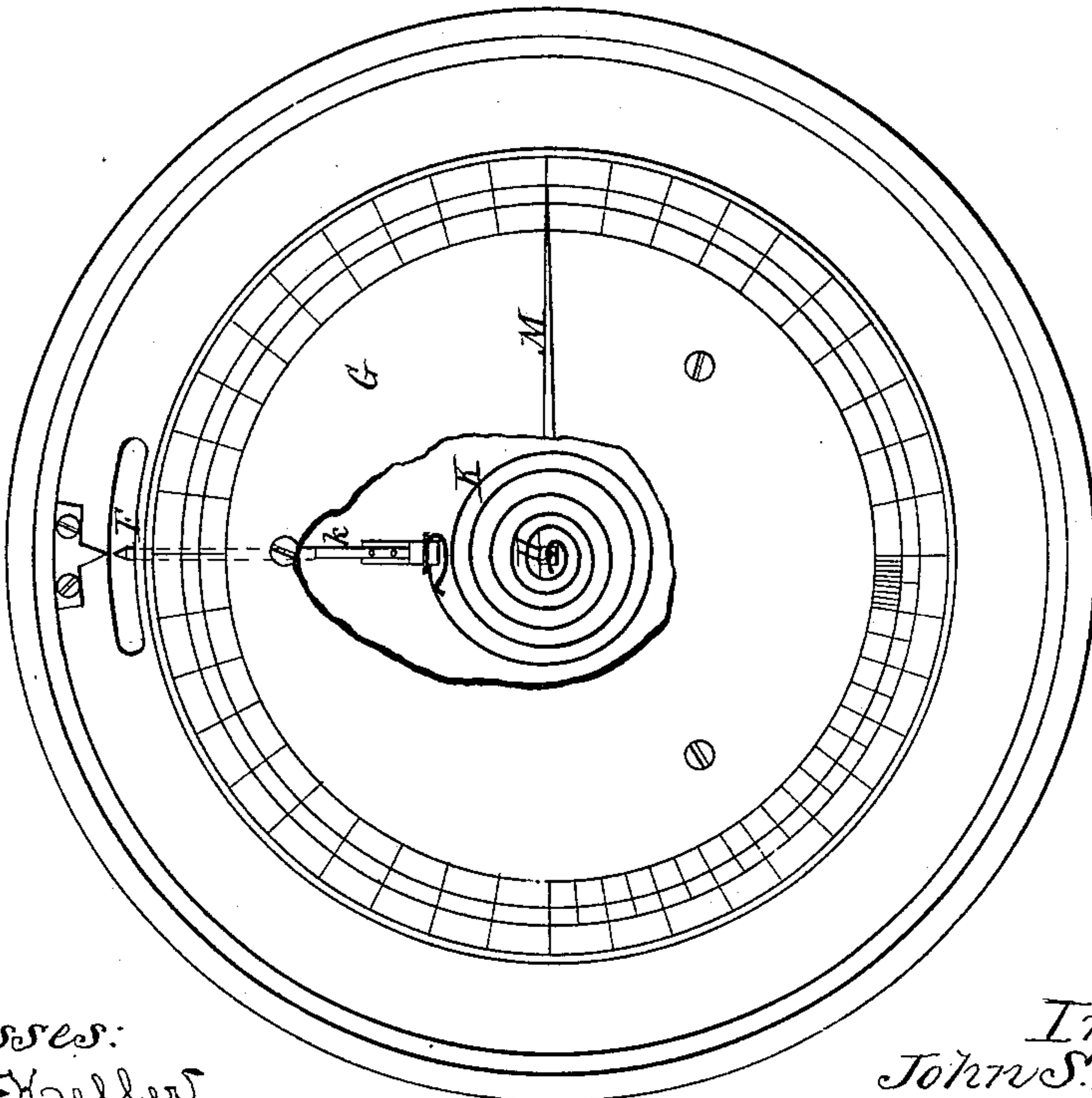


Fig. 3



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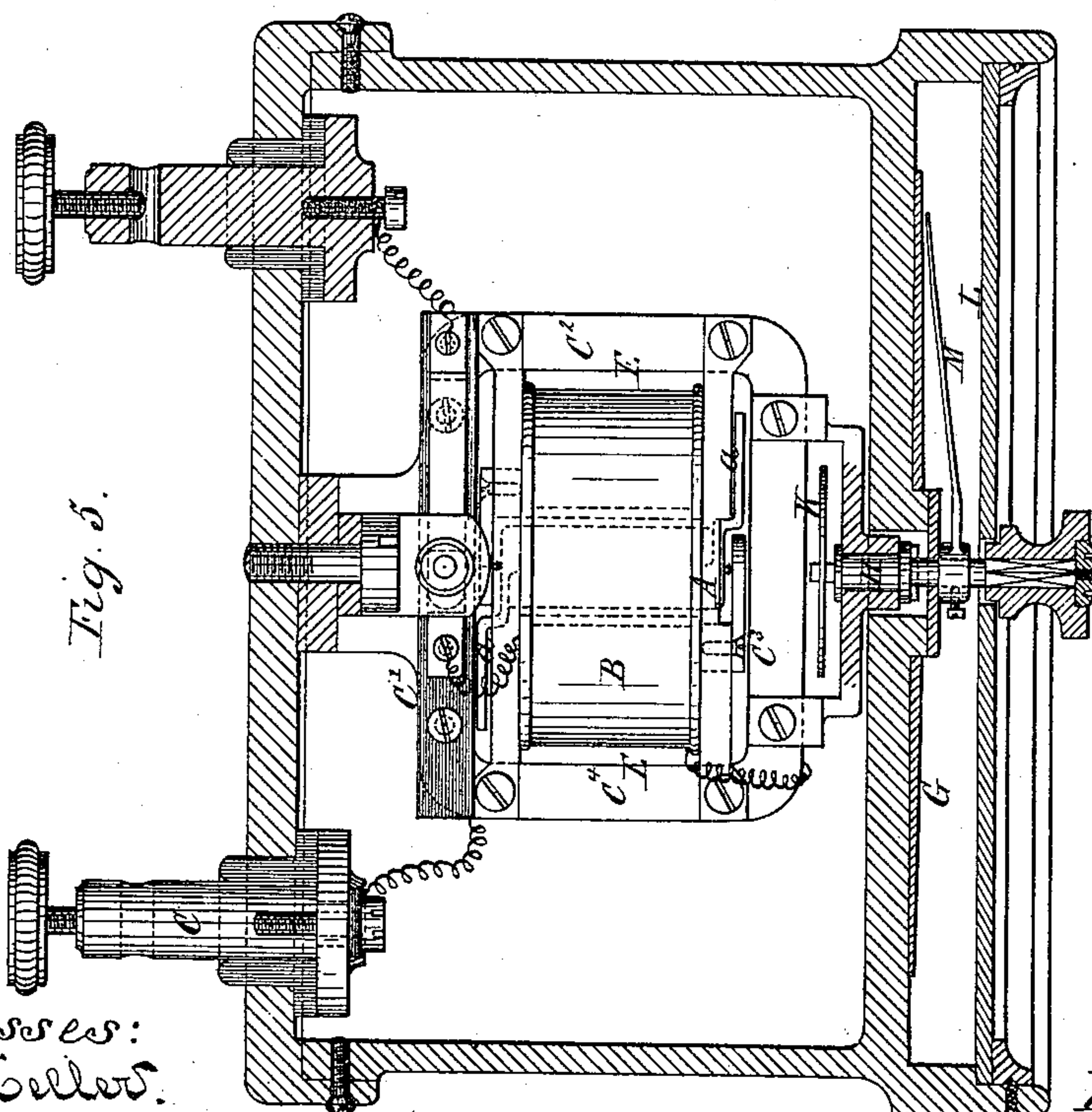
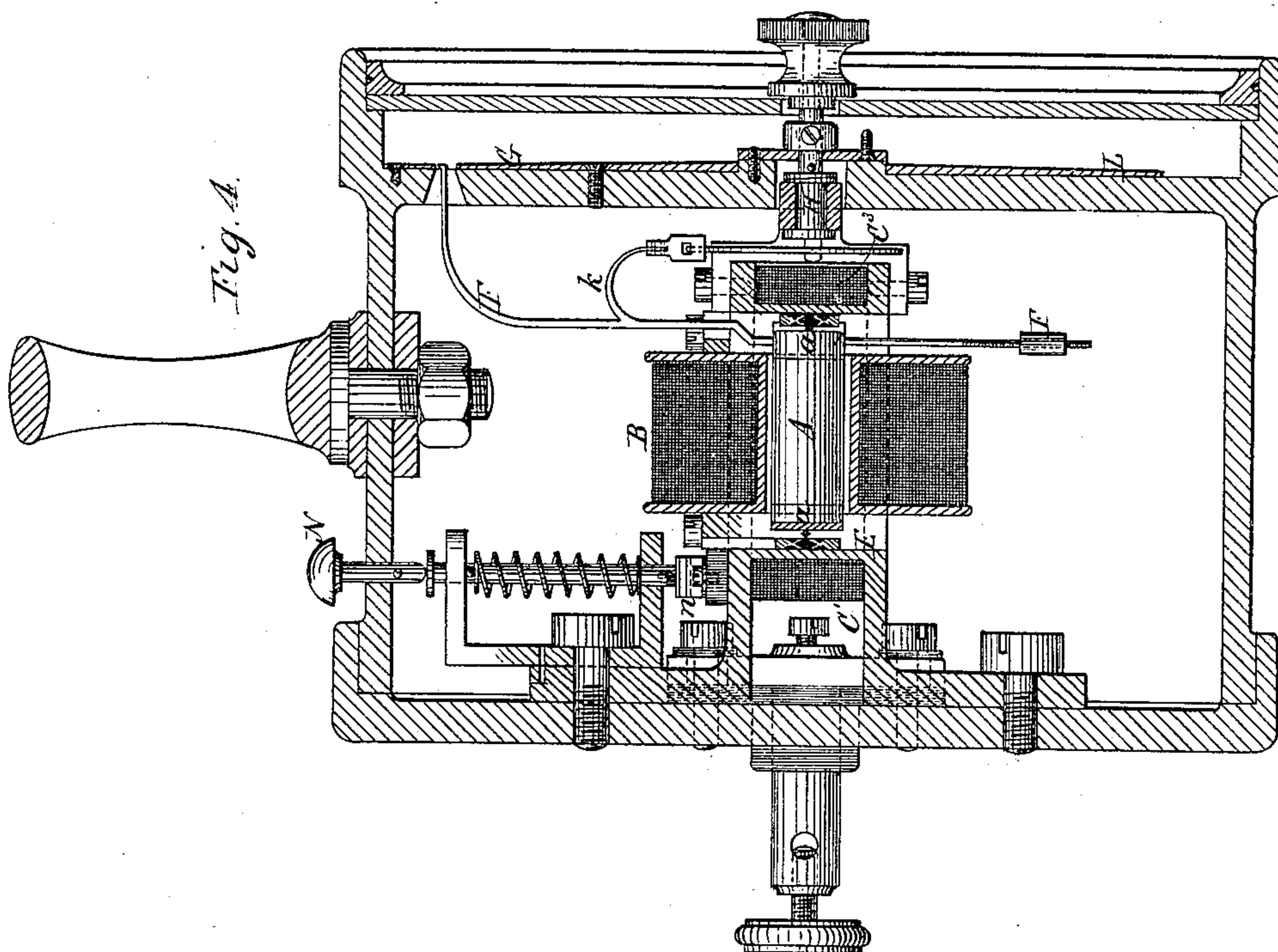
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UNITED STATES PATENT OFFICE.

JOHN SMITH RAWORTH, OF MANCHESTER, COUNTY OF LANCASTER, AS-SIGNOR TO SIEMENS BROTHERS & COMPANY, (LIMITED,) OF 12 QUEEN ANNE'S GATE, WESTMINSTER, COUNTY OF MIDDLESEX, ENGLAND.

ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 338,549, dated March 23, 1886.

Application filed February 25, 1885. Serial No. 157,027. (No model.) Patented in Eng'land May 13, 1884, No. 7,668; in France February 14, 1885, No. 167,046; in Germany February 15, 1885, No. 33,950, and in Belgium February 17, 1885, No. 67,920.

To all whom it may concern:

Be it known that I, JOHN SMITH RAWORTH, a citizen of England, residing at Manchester, in the county of Lancaster, England, have invented a new and useful Electric Meter, (for which I have obtained a patent in Great Britain, dated May 13, 1884, No. 7,668,) of which the following is a specification.

My invention relates to an electric meter—that is to say, an instrument for measuring the electric current in a circuit—in which case it may be termed an “electro-dynamometer,” or with suitable modifications for measuring the electro-motive force, in which case it may be called a “volt-meter.” For both purposes the principles of action are the same, but the construction is so far modified as to suit two different conditions, the chief modification being in the character of the coils employed. In the one case, for the electro-dynamometer a coil-conductor of large sectional area and very low resistance is used. In the other case, for the volt-meter coils of fine wire and very high resistance are used.

I will describe both forms, referring to the accompanying drawings, in the several figures of which the same reference-letters are as much as possible employed to indicate corresponding parts.

Figure 1 is a vertical section, and Fig. 2 is a sectional plan, of an electro-dynamometer according to my invention, Fig. 3 being a front view showing the parts immediately behind the dial, which is supposed to be removed. Fig. 4 is a vertical section, and Fig. 5 a sectional plan, of the modified form of the instrument constituting a volt-meter, Fig. 6 being a transverse section.

A is an iron spindle, delicately pivoted at its ends, where there are two iron arms, *a a*, projecting from it in opposite directions. Around the spindle A there are conducting-coils B, consisting for the electro-dynamometer, as shown in Figs. 1 and 2, of a few convolutions of copper bar of rectangular section helically wound without contact with each other; but in the volt-meter, as shown in Figs. 4 and 5, consisting of numerous convolutions of fine in-

sulated wire. In either case, when these coils are acted on by electricity, the spindle A becomes polarized, its arms *a a* constituting polar extensions of the magnet into which it is converted. As shown in Fig. 2, the electric current entering by the post C passes along a metallic framing, C' C² C³, through the coil B, and out by the post D, or in the reverse direction. In passing along the parts of its circuit C' and C³ which are parallel to the arms *a a* it tends to deflect them, and so to turn the spindle A partly round with more or less force, according as the current is greater or less. As shown in Figs. 4, 5, and 6, the electric current entering by the post C passes through a number of convolutions of fine insulated wire, C' C² C³ C⁴, wound round a rectangular casing, E, outside the spindle A and its coil B. In this case also the current in the parts C' and C³ of the rectangular coil is parallel to the arms *a a*, and tends to deflect them the more the greater the electro-motive force.

At the front end of the spindle A is fixed a light index-wire, F, which may be of aluminium. It is counterbalanced by an adjustable weight, F', and is bent forward so as to project through a hole in a dial, G. Through this dial passes a central spindle, H, which can be turned by hand, and which has fixed to its inner end the innermost convolution of a volute spring, K, the outermost convolution of which is connected by an arm, *k*, to the index-wire F.

On the spindle H, outside the dial G, and protected by a glass, L, there is fixed an index, M, pointing to graduations on the dial. When the instrument is put in circuit, the spindle H is turned by hand until the force of the volute spring K is made to balance the force tending to turn the spindle A by deflecting the arms *a a*, as can be seen by observing the point of the wire F just vibrating within the hole of the dial through which it passes. The index M will then point to a graduation on the dial G, by which can be ascertained the number of ampères in the current acting on the electro-dynamometer or the number of volts in that acting on the volt-meter.

As shown in Figs. 4 and 6, a key, N, pressed

upward by a spring, can be used to put the volt-meter in circuit by pressing down this key by the finger, and thereby bringing into contact two metallic springs, *n n*, by which the circuit of the instrument is closed.

No claim is herein made to features described in this application which are claimed in another application, No. 176,931, filed September 12, 1885.

10 Having thus described the nature of my invention and the best means I know for carrying it out in practice, I claim—

1. In an electric meter, the combination of a spindle which is turned by hand, a spring connecting the spindle turned by hand with a magnetic spindle, and a magnetic spindle whereby in each operation the operator in turning the spindle turned by hand puts an increasing tension upon the spring until it balances the deflecting force of the current, as and for the purposes described.

2. The combination of the spindle H, the spring K, connecting the spindle H to the magnetic spindle A, the magnetic spindle A, the indicator F, and the needle M, which turns

with the spindle H, as and for the purposes described.

3. The combination of the spindle A, having two small arms, *a a*, projecting from it in opposite directions, the conducting-coils B, consisting of convolutions of copper bar helically wound without contact with each other, the metallic framing C' C² C³, the index-wire F, counterbalanced by an adjustable weight, F', and projecting through the dial G, the central spindle, H', passing through the dial, and the volute spring K, connected by the arm *k* to the index-wire, as and for the purposes described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 4th day of February, A. D. 1885.

JOHN SMITH RAWORTH.

Witnesses:

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