(No Model.)

E. G. WILLYOUNG.

ELECTRICAL MEASURING INSTRUMENT.

No. 516,855. Patented Mar. 20, 1894.

Fig. 1.

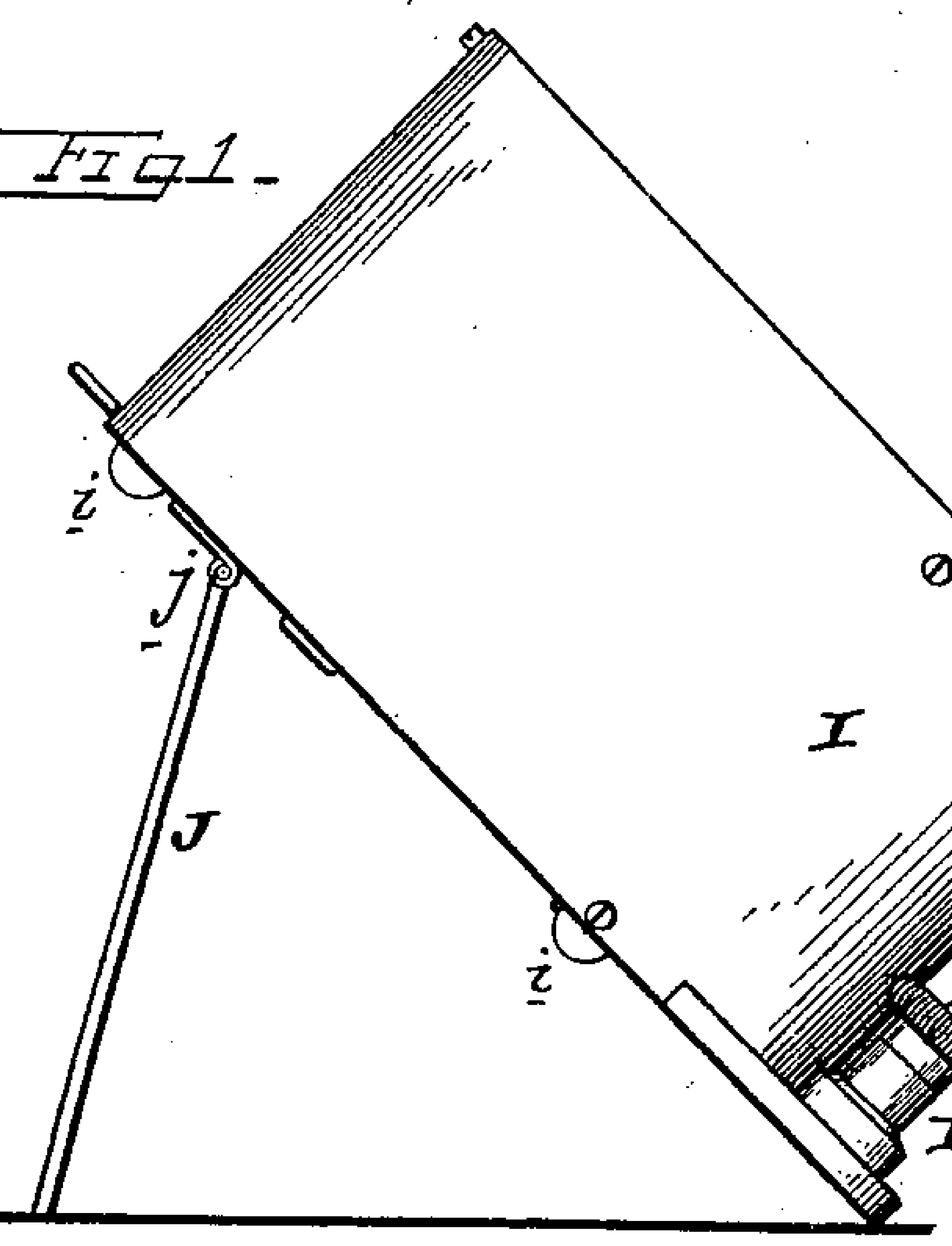


Fig. 2.

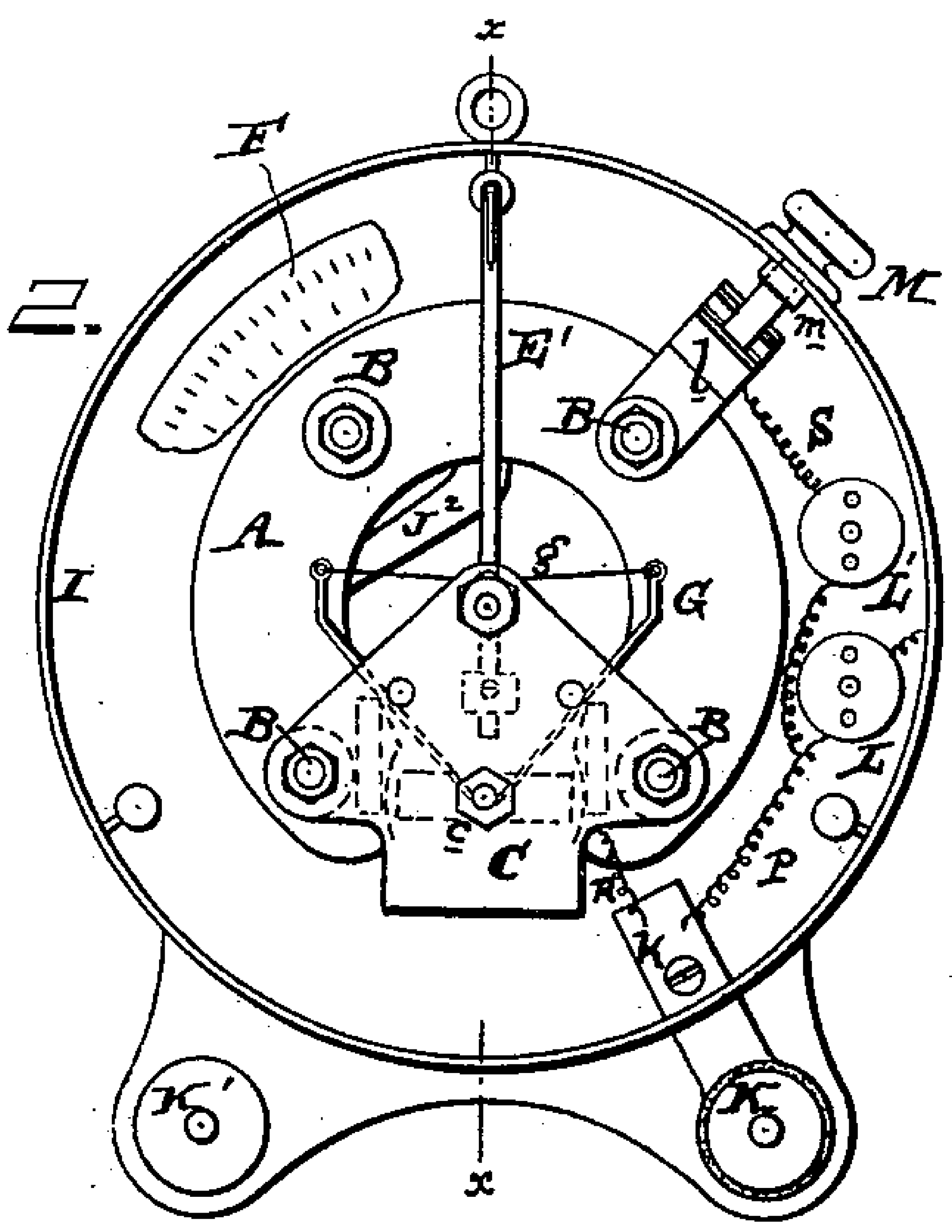


Fig. 3.

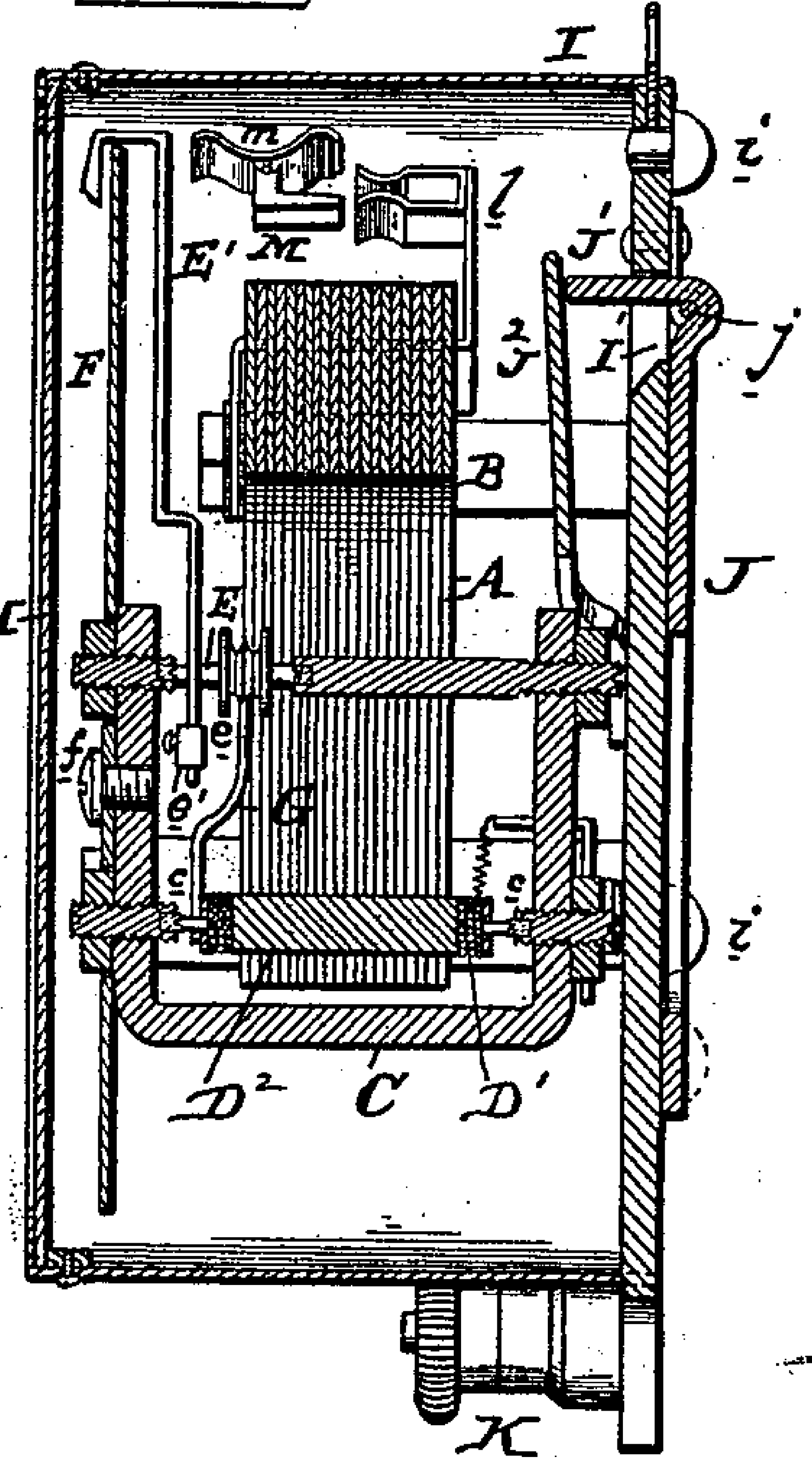


Fig. 4.

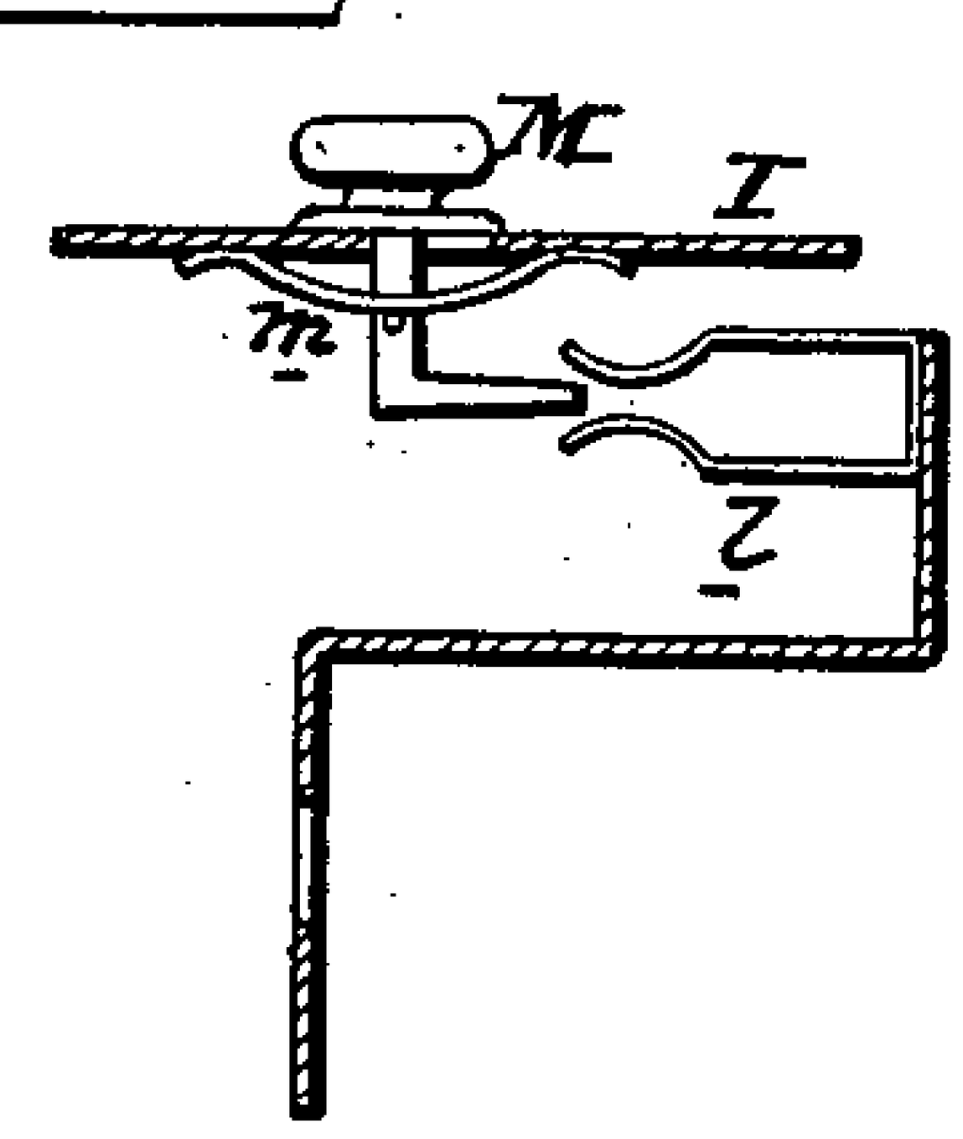


Fig. 5.

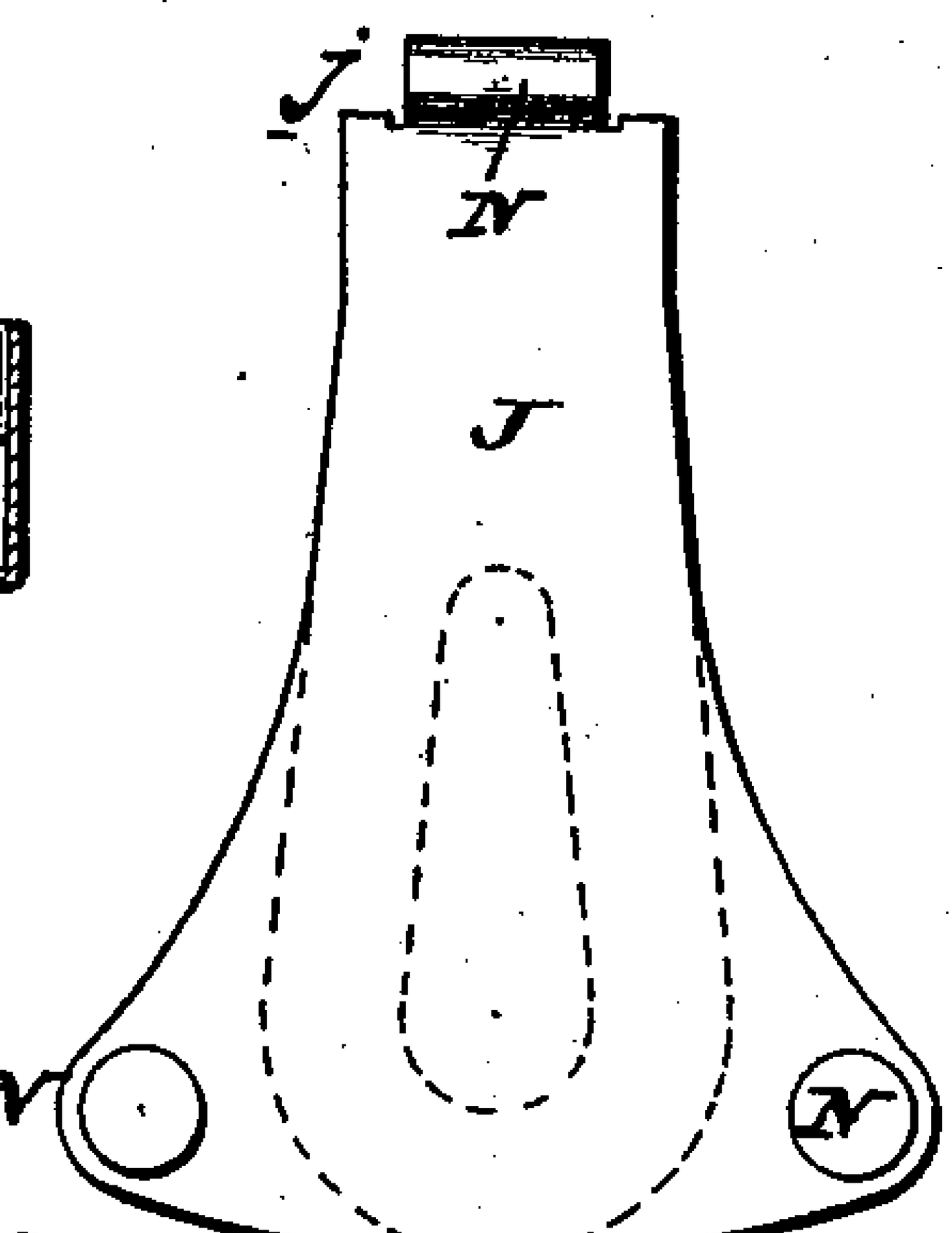


Fig. 6.

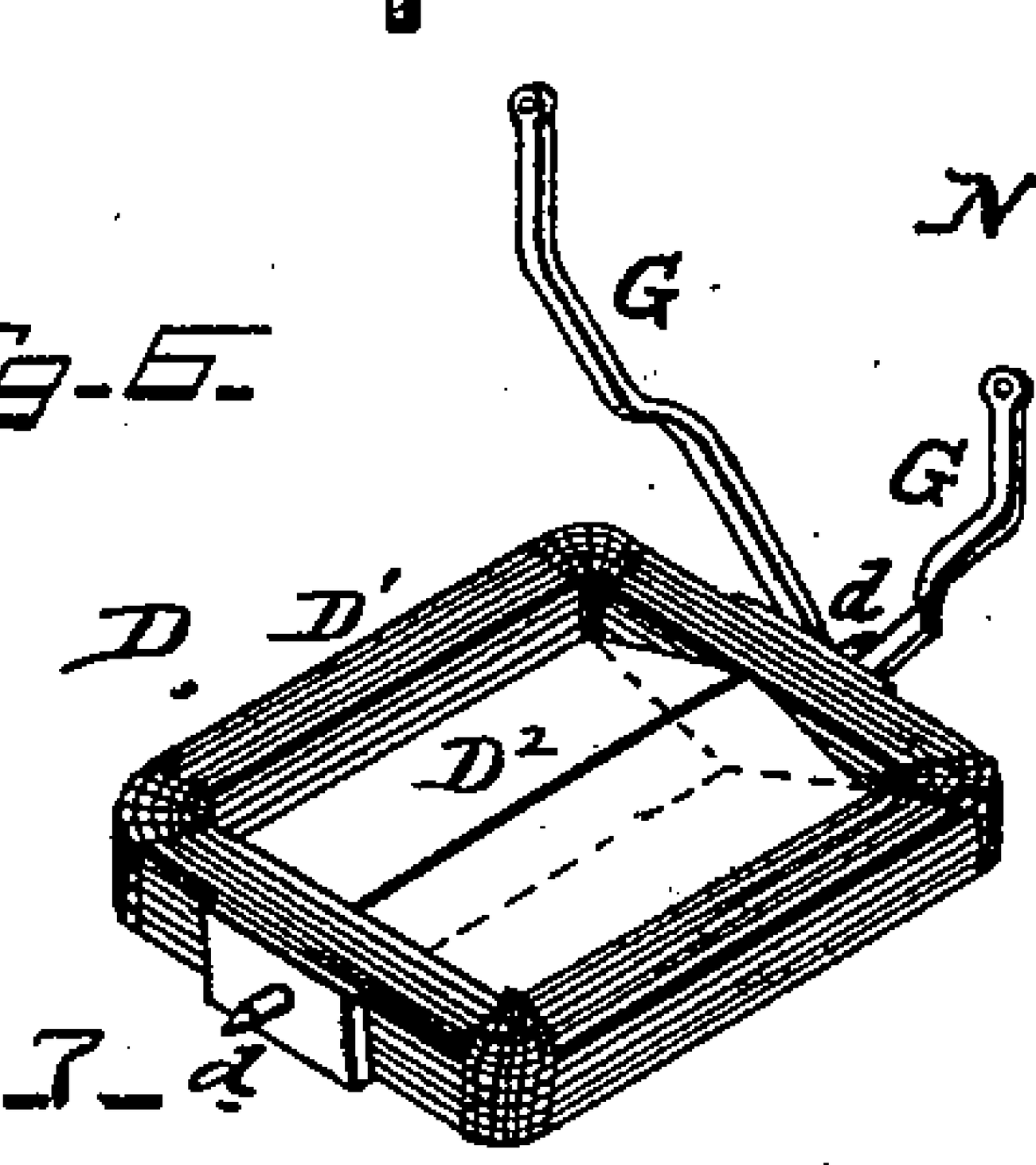


Fig. 8.

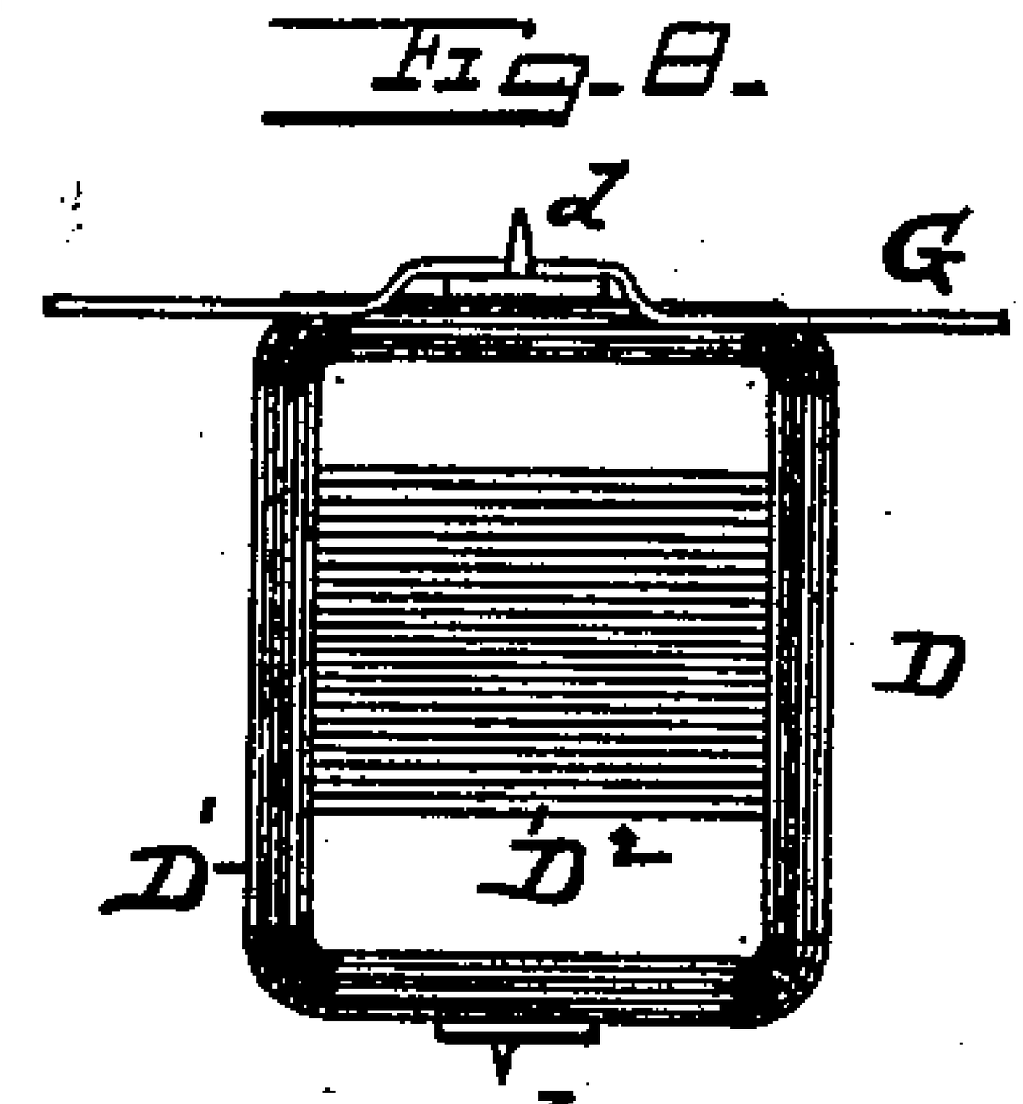
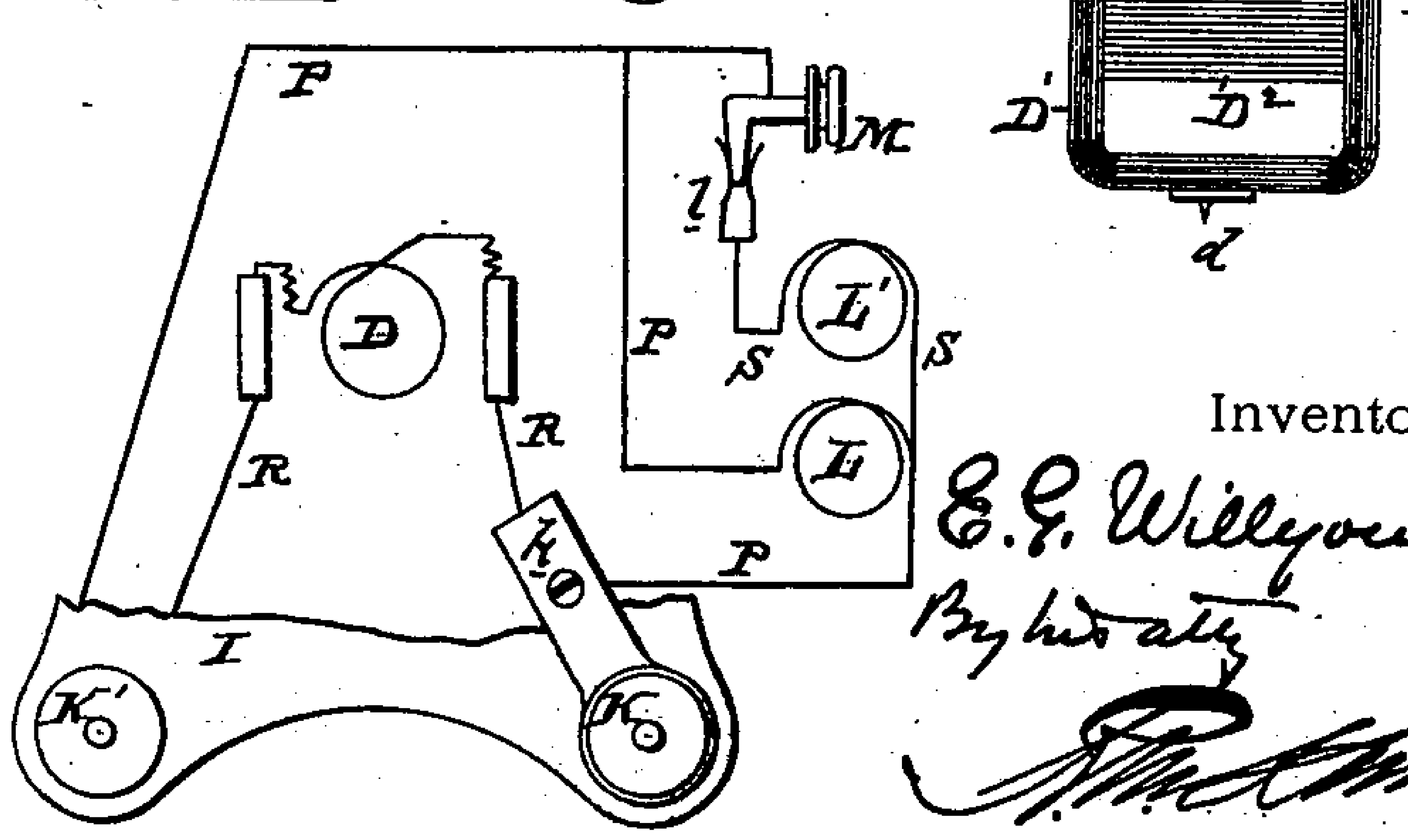


Fig. 7.



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ELECTRICAL MEASURING-INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 516,855, dated March 20, 1894.

Application filed June 23, 1893. Serial No. 478,580. (No model.)

To all whom it may concern:

Be it known that I, ELMER G. WILLYOUNG, of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Electrical Measuring-Instruments, of which the following is a specification.

My invention has reference to electrical measuring instruments, and consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings, which form a part thereof.

My invention relates more particularly to that class of instruments which are designed to measure currents traversing electrical conductors and commonly known as volt-meters or ammeters, and comprehends certain specific improvements in the general construction of such instruments as have heretofore been in use. The particular instrument illustrated is a sensitive instrument called a milliampère meter.

My object is to simplify the construction whereby there shall be economy in assembling the parts and also in the cost of manufacture.

My object is further to provide a suitable support which may be employed to hold the instrument in an inclined position so as to be readily read, the said support being combined with the case so that it may be so turned as to offer no obstruction in packing the instrument or when the same is laid flat upon its back as is required for convenience under some conditions in testing.

My invention also comprehends certain improvements in the construction of the armature with the object in view of making the instrument accurate in returning to zero after the current is interrupted; and also in providing additional resistances within the instrument which may be cut into or out of circuit, and when active be in shunt relation with the armature coils.

The details of construction will be better understood by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of my improved electric measuring iustrument supported in position for reading. Fig. 2 is a front elevation of the instrument with the glass and dial plate removed. Fig. 3 is a sectional elevation of the instrument on lines *x*—*x*. Fig. 4 is a sectional elevation of the switch adapted to put in or out of circuit the additional resistances. Fig. 5 is an elevation of a modified form of support. Fig. 6 is a perspective view of the armature. Fig. 7 is a diagrammatic view illustrating the electric circuits of the instrument; and Fig. 8 is a plan view of another form of my improved armature.

A are the field magnets and are formed similar to a slotted annular ring consisting of an inverted U shaped structure. These field magnets are made of a series of stamped steel plates arranged one upon the other and held in position to the back of the case I by four bolts B of any suitable construction. By means of the said bolts, the field magnets are held suspended in the center of the case. By making the field magnets of stamped sheet steel absolute accuracy in construction is obtained, and the composite magnet is much cheaper to make than a solid cast or forged magnet of the same shape, it may also, being laminated, be much more intensely magnetized, as is well known in the art.

C is a frame of brass made U shaped and arranged in a transverse plane to the field magnets and is also sustained by the two lower bolts B, B, which hold the field magnets in place within the case I. In this manner the frame C is fixedly supported with reference to the poles of the field magnets. The frame C has an upwardly extending portion at the front and rear forming supports for central pivots preferably concentric with the center of curvature of the field magnets A and the case I, and in said pivots is supported the rock shaft E carrying the needle or pointer E′ which may be counter-weighted at *e′*.

F is a dial plate peferably circular in shape and is secured to the frame C by means of suitable screws *f*. The zero of the scale would be at the top of the plate and the scale would be graduated in opposite directions from this point. The shaft E is provided with a grooved wheel of any suitable construction *e* about which a cord of silk or other suitable material *g* passes, and the ends of which are connected to the extremities of the upwardly extending

arms G secured to armature D. The armature consists of coils D′, and preferably an internal soft iron core D^2. The coil of the armature is open in the center and supported within it is a soft iron core which may be either formed diamond shaped in cross section as indicated in Fig. 6 or of a series of transverse annealed wires D^2 as shown in Fig. 8, the latter being somewhat more preferable than the former in that it does not retain magnetism after the cessation of the current, and permits the pointer or needle to more positively return to zero under all conditions when the circuit is open. The ends of the armature are provided with pivots *d* which are pivoted in suitable bearings *e* carried in the lower part of the uprights of the frame C. The armature coil is of insulated wire D′ preferably bent into rectangular shape, and is pivoted so as to swing between the poles of a field magnet A. The swinging of this armature and its action through the arms G and the cord *g* causes the pointer or needle E′ to traverse the scale or dial plate F.

The case I is provided with a glass face H through which the instrument may be read, and at its lower part it is provided with two feet which receive the binding posts K and K′ respectively. The binding post K′ is directly connected with the case of the instrument, while the binding post K is insulated therefrom and connects with the electric circuits R and P by plate *k* as is clearly shown in Figs. 2 and 7. The circuit R leads to the armature coils and thence to the case. The circuit P leads from the plate *k* through a resistance coil L and thence to the case of the instrument.

S is an additional circuit including the second resistance coil L′ and may be thrown in parallel with the resistance coil by means of a contact *l* and a switch M. The construction of this switch is clearly shown in the various figures. The contact *l* is supported and insulated in any suitable manner from one of the bolts B, and presents spring surfaces with which the switch M makes connection.

The switch M consists of a movable part extending through the case I and movable in a slide therein, and is so combined with a spring *m* working upon the inside of the case that it holds the switch M in any position in which it may be moved by the hand. When the switch is depressed it connects with one of the terminals of the circuit S with the case and hence in that position puts it and its resistance L′ in parallel with the resistance L. The object of the resistances L and L′ is to shunt more or less of the current about the movable coils in the fixed field. The shunt coil L is permanently in circuit and the shunt coil L′ is only thrown into circuit when the current in the line to be measured is excessive and in that case the movement of the pointer over the dial plate would be less for a given current than in the first instance.

In place of assuming the divisions of the scale to be different in one case than in the other by a constant multiplier I may employ two scale markings upon the dial plate, one to be used with the shunt coil L′ in circuit, and the other without this shunt coil in circuit.

J is a pivoted support hinged at *j* to the back of the case I and is provided with an inwardly projecting arm J′ passing through a slot I′ in the back of the case and resting against a spring J^2 carried upon the interior of the case. The spring J^2 holds the support J in its closed position as shown in Fig. 3, and yet permits the said support J to be turned outward to the position shown in Fig. 1 until the projection J′ strikes the lower face of the slot I′ in which position it is held by the spring J^2. The instrument then rests upon the two forward feet adjacent to the terminal binding posts and the supporting frame at the rear. The supporting frame J in the instance just described is preferably formed with its lower part shaped as indicated in dotted lines in Fig. 5. The rear of the case is provided with rivets or feet of any suitable construction *i* so disposed that when the instrument is laid flat upon its back, it rests upon the said feet and is not liable to tilt or wabble. In place of putting these feet *i* upon the case they may be wholly or in part placed upon the arm J as indicated at N. The hinge joint *j* is also shaped to correspond to one of these feet N and by so distributing the said feet they will cover sufficient area to make the instrument stable. It is evident that the feet may be partly on the back of the case I and partly on the frame J.

I do not confine myself to the mere details of construction as they may be modified in various ways without departing from the principles of the invention.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an electrical measuring instrument, the combination of a permanent magnet, a movable armature pivoted between the poles of the magnet, a dial, a pointer movable over the dial by the armature, terminal posts, an electric circuit between the terminal posts including the armature, a second circuit between the terminal posts in parallel with the armature including a shunt resistance coil, a third circuit between the terminal posts in parallel with the armature and shunt resistance coil, a second shunt resistance coil included in the third circuit, and a switch carried by the instrument for opening or closing the third circuit.

2. In an electrical measuring instrument, the combination of a permanent magnet, a movable armature pivoted between the poles of the magnet, a dial, a pointer movable over the dial by the armature, terminal posts, an

electric circuit between the terminal posts including the armature, a second circuit between the terminal posts in parallel with the armature including a shunt resistance coil, a third circuit between the terminal posts in parallel with the armature and shunt resistance coil, a second shunt resistance coil included in the third circuit, and a switch consisting of a contact fixedly supported within the case, and a movable contact extending through the case to the exterior thereof and movable in connection with the fixed contact for closing or opening the third circuit.

3. In an electrical measuring instrument, the combination of a permanent magnet, a movable armature pivoted between the poles of the magnet and consisting of a coil of insulated wire having interposed between the sides of the coil adjacent to the poles of the fixed magnet a transverse soft iron metallic part movable with the coil and formed of transversely laminated sections, terminals including the coil of the armature, and a movable pointer or needle operated by the armature.

4. In an electrical measuring instrument, the combination of permanent field magnets formed of a series of superimposed stamped sheet sections of steel, clamping bolts therefor to hold the several sections in position, an inclosing case secured to the bolts, a pivoted armature arranged to move between the poles of the permanent magnets, terminals exterior to the case and electrically connected with the armature coils, a dial plate, and a needle or pointer movable over the dial plate and moved by the armature.

5. In an electrical measuring instrument, the combination of permanent field magnets formed of a series of superimposed stamped sheet sections of steel, clamping bolts therefor to hold the several sections in position, an inclosing case secured to the bolts, a U shaped frame of diamagnetic material secured to the field magnets, a pivoted armature arranged to move between the poles of the permanent magnets and carried by the U shaped frame, terminals exterior to the case and electrically connected with the armature coil, a dial plate secured to the U shaped frame and supported thereby, and a needle or pointer also supported by the U shaped frame and movable over the dial plate by the armature.

In testimony of which invention I have hereunto set my hand.

ELMER G. WILLYOUNG.

Witnesses:
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