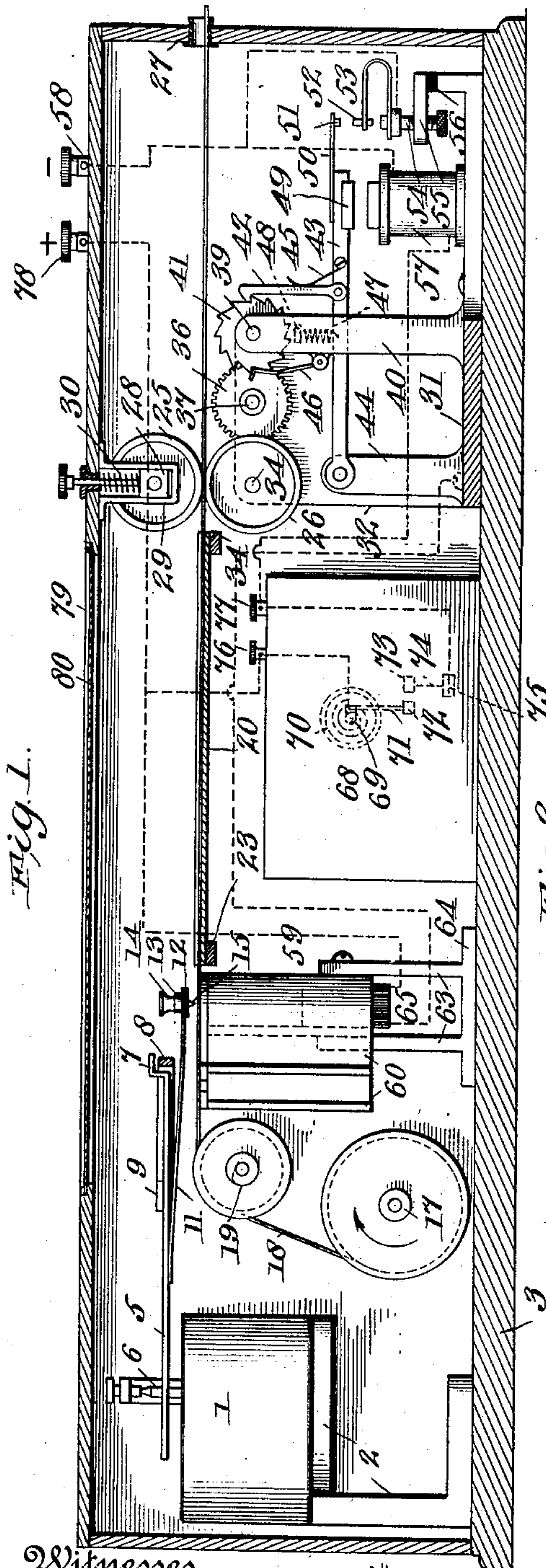


No. 848,329.

PATENTED MAR. 26, 1907.

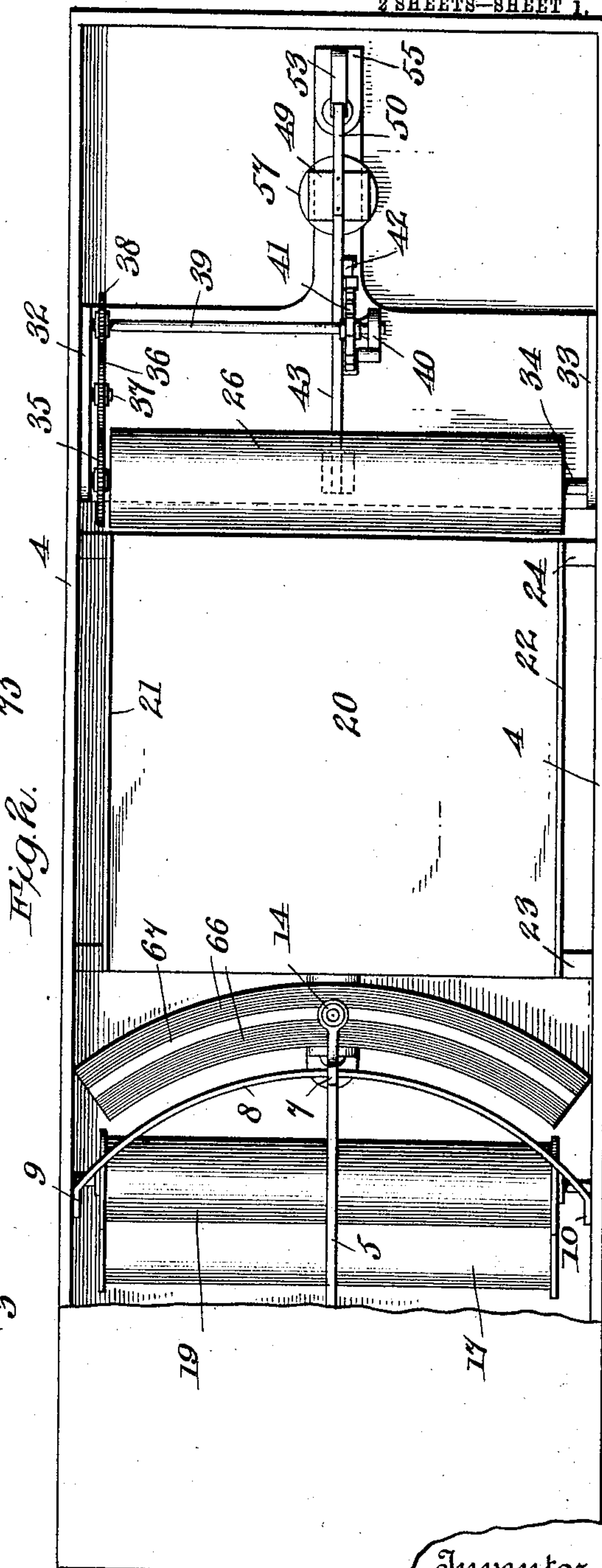
C. E. VAWTER, JR.  
RECORDING INSTRUMENT.  
APPLICATION FILED JUNE 27, 1906.

2 SHEETS—SHEET 1.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 3.

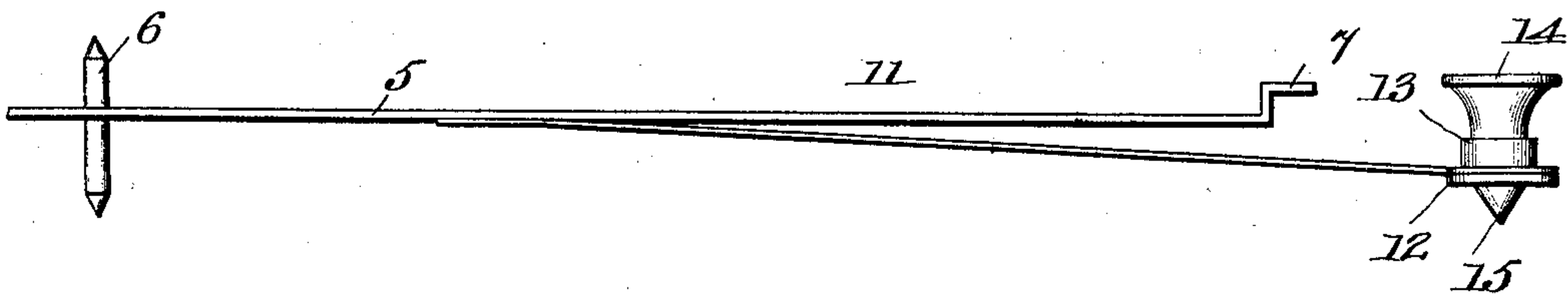


Fig. 4.

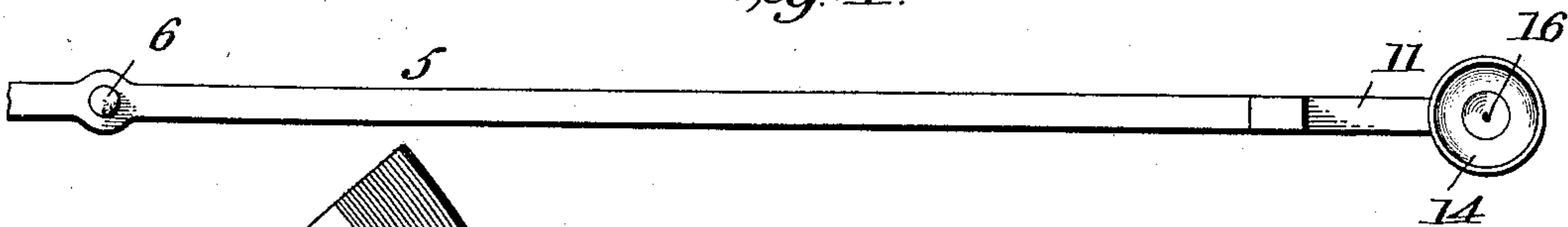


Fig. 5.

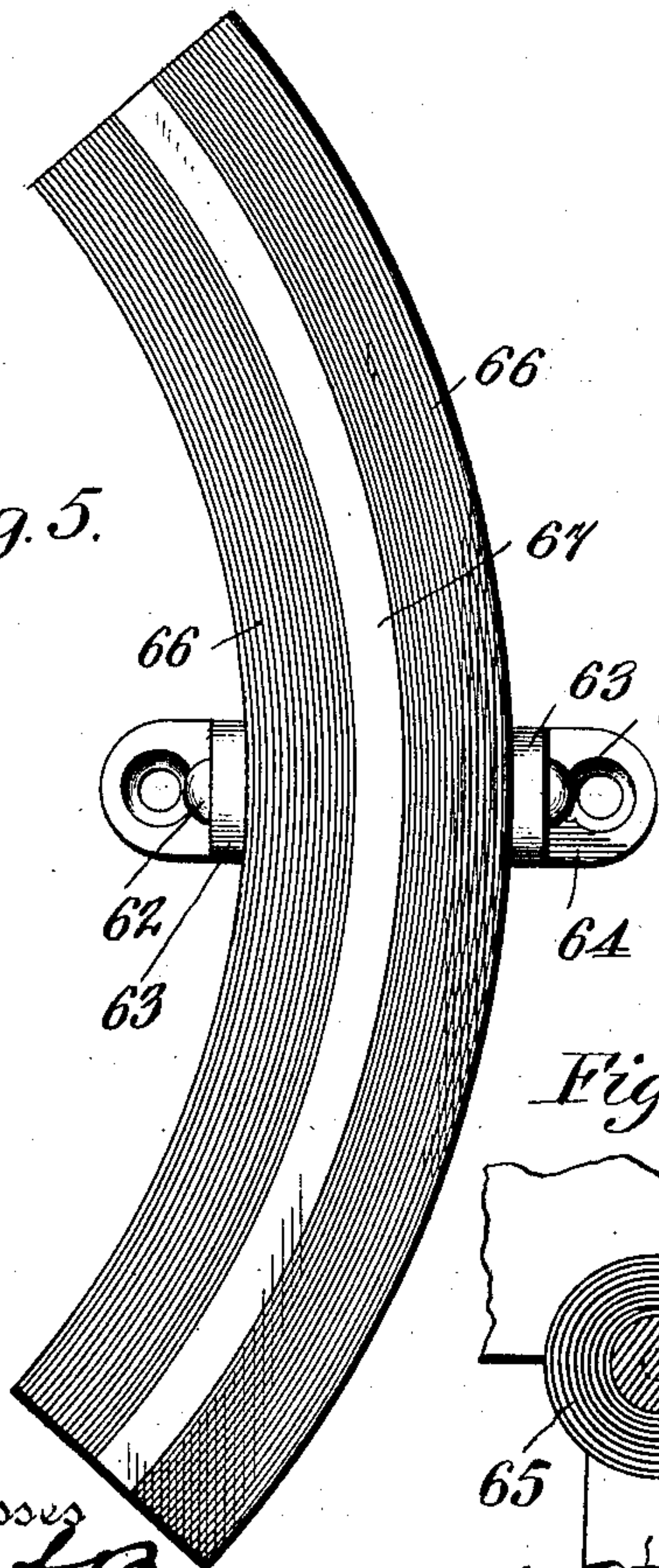


Fig. 6.

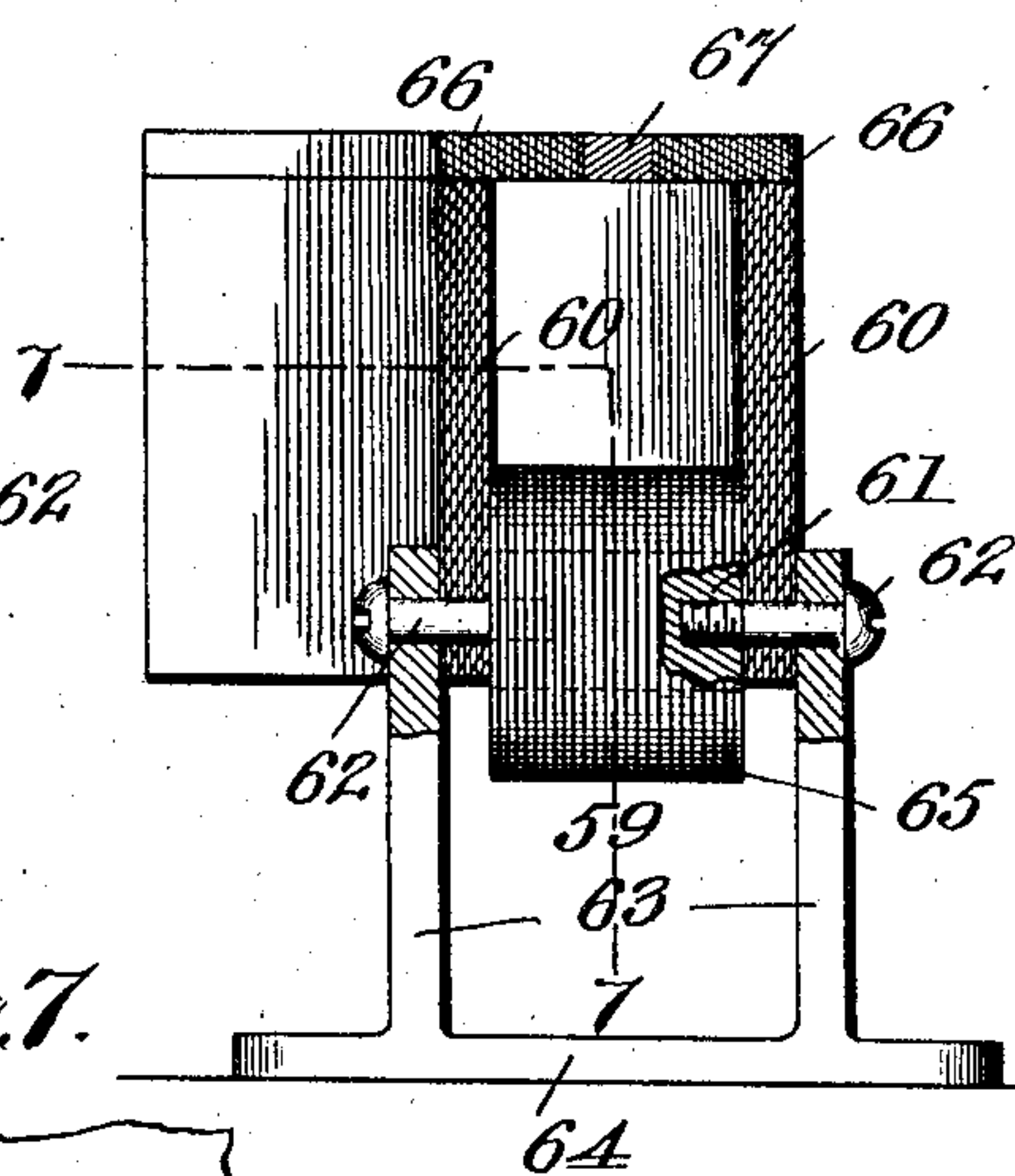
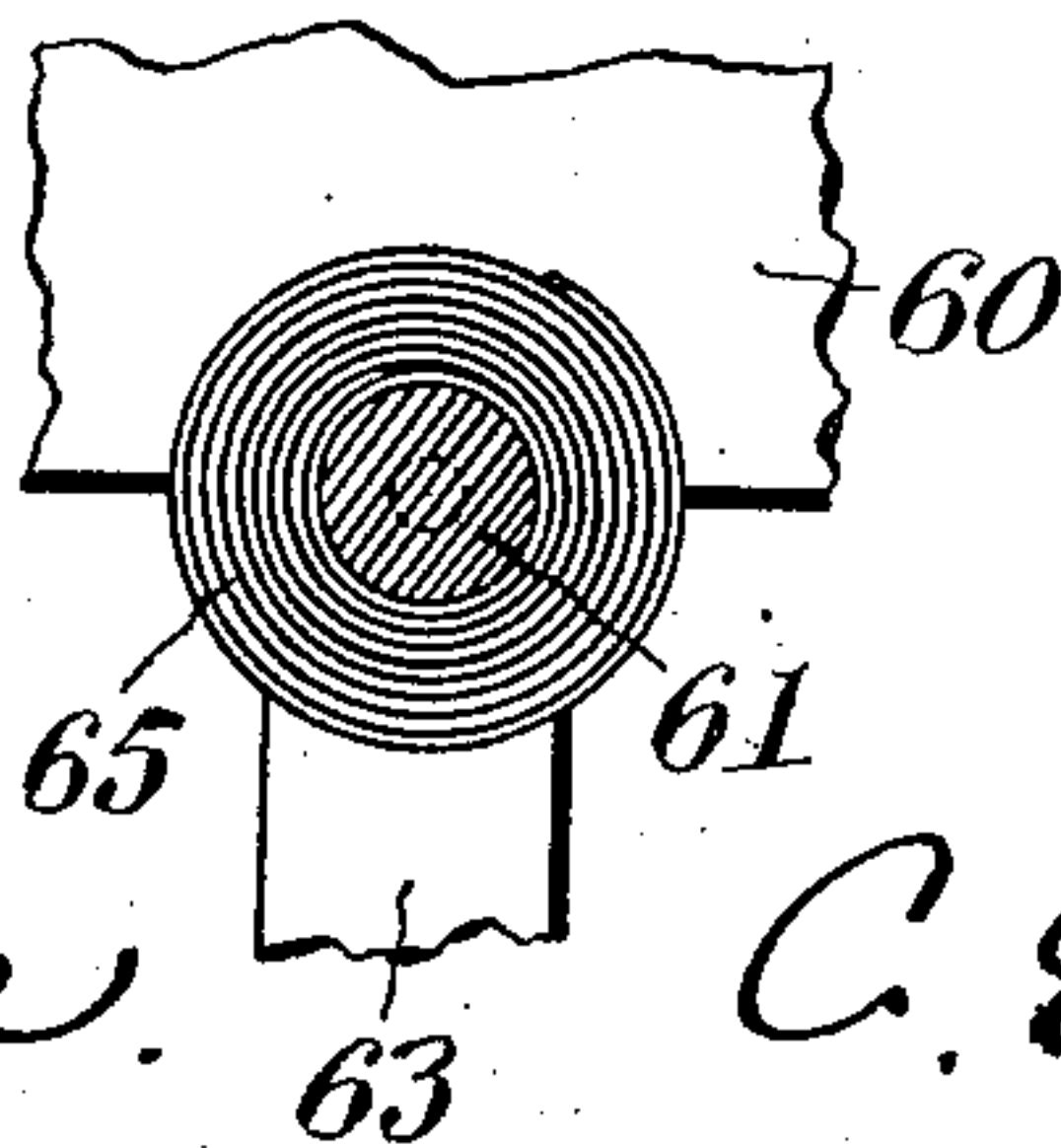


Fig. 7.



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# UNITED STATES PATENT OFFICE.

CHARLES E. VAWTER, JR., OF BLACKSBURG, VIRGINIA.

## RECORDING INSTRUMENT.

No. 848,329.

Specification of Letters Patent.

Patented March 26, 1907.

Application filed June 27, 1906. Serial No. 323,600.

*To all whom it may concern:*

Be it known that I, CHARLES E. VAWTER, Jr., a citizen of the United States, residing at Blacksburg, in the county of Montgomery and State of Virginia, have invented certain new and useful Improvements in Recording Instruments, of which the following is a specification.

This invention relates more especially to improvements in recording instruments, such as voltmeters, ammeters, wattmeters, and other recording instruments in which an index is arranged to move over a recording-sheet or other impression-receiving surface and to record thereon periodically, the said invention constituting an improvement on the instrument forming the subject-matter of United States Patent No. 807,518, granted to me December 19, 1905.

In order to more fully describe my present invention, reference will be had to the accompanying drawings, wherein similar parts are represented by similar reference-numerals throughout the several views, in which—

Figure 1 represents one form of the instrument embodying my present invention, partly in side elevation and partly in longitudinal vertical section; Fig. 2, a top plan view of the said instrument with a portion of the cover removed and broken away; Fig. 3, an enlarged detailed side elevation of the index-arm and marking device carried thereby; Fig. 4, a top plan view of the same; Fig. 5, an enlarged detail plan view of the electromagnet for operating the marking device; Fig. 6, a central vertical section thereof; and Fig. 7, a detail fragmentary section taken along the line 7-7, Fig. 6, looking to the left.

Referring to the accompanying drawings, 1 represents a voltmeter, ammeter, wattmeter, or other instrument mounted upon a suitable support 2, made fast to the base 3 of the instrument-casing 4.

The instrument 1 is provided with an index-arm 5, preferably of aluminium or other light material having one point of support, as the pivot 6, or other suitable supporting means to permit of the angular movement of the index and a free end, which latter is provided with an offset portion 7, directly beneath which is located a frame 8, extending in an arc of a circle across from one side of the instrument-case to the other, to which it is made fast, as at 9 and 10. (See Fig. 2.) This frame 8 acts as a stop to limit the move-

ment of the index-arm 5 in one direction at right angles to its angular movement.

Made fast to the index-arm 5 is an elongated resilient arm 11, preferably of a thin piece of bronze, steel, or other suitable material. This arm forms an extension of the index-arm and carries at its outer free end, in the case shown, an armature 12, consisting of a small piece of magnetic metal made fast to the strip 11. Made fast upon the upper face of the outer end of the strip 11 and directly above the armature 12 is a collar 13. Fitting tightly into this collar and extending through the armature 12 is a marking device consisting in the case shown of a small, preferably aluminium, ink-receptacle 14, converging at its lower end to a point, as at 15, through which latter passes a small opening 16 to form an outlet for the ink. Obviously the extra armature 12 may be omitted if the strip 11 is itself of magnetic metal. It is preferred, however, to employ an extra thickness of magnetic metal at the point occupied by the armature 12 whether the entire arm 11 be of magnetic metal or not.

Mounted within the case of the instrument is a suitable reel 17, upon which is carried a recording-sheet 18, which may be of the same character as shown and described in United States Patent No. 807,518, heretofore referred to. This sheet coming from the reel 17 passes over a guide-roller 19 and thence beneath the recording-point 15 over a suitable guide-plate 20, having side flanges 21 22 and mounted upon cross-pieces 23 24, made fast to the sides of the instrument-case. The recording-sheet then passes between feed-rollers 25 26 and thence out through opening 27 in one end of the instrument-case. In order to secure the desired pressure between the rollers 25 26, the former is journaled at each end in an adjustable bearing 28, slidable in a bracket 29 against the tension of a spring 30. Located near the right-hand end of the instrument in Figs. 1 and 2 is a suitable supporting-frame 31, having two side uprights 32 and 33, in which the shaft 34 of the feed-roller 26 is journaled. Mounted fast on the same shaft with the feed-roller 26, at one end thereof, is a gear 35, which meshes with an intermediate gear 36, mounted upon a spindle 37, secured to the upright 32, and this intermediate gear 36 in turn meshes with a gear 38, which is made fast on a shaft 39, journaled at one end in the upright 32 and at the other end an upright 40 of the frame 31.



Also made fast upon the shaft 39 is a ratchet-wheel 41, which engages a pawl 42, carried by a lever-arm 43, fulcrumed at one end in the upright 44 of the bracket 31. The ratchet 42 is held normally in engagement with the ratchet-wheel by a spring 45, and the ratchet is prevented from rotating in the wrong direction by the spring 46. The lever-arm 43 is held in its normal position by means of a spring 47, secured at one end to said arm and at the other to a lug 48 on the upright 40. The arm 43 carries at its free end an armature 49 and a resilient metal contact-strip 50, having a platinum or other suitable contact-point 51, which latter is located directly above a platinum or other suitable contact-point 52, extending through and made fast to a substantially U-shaped resilient metal strip 53, made fast at one end to an adjusting-screw 54, mounted in an arm 55, insulated, as at 56, from the metal of the frame 31. Made fast to the frame 31 and located directly below the armature 49 is an electromagnet 57, the object of which is to operate, through the ratchet-and-pawl mechanism, the feed-roller 26 and to cause the completion of a circuit hereinafter more particularly described. For this purpose one coil-terminal of the magnet 57 is electrically connected to one of the instrument binding-posts 58, while the other coil-terminal is electrically connected to the clock binding-post 77, as shown in dotted lines, Fig. 1.

For the purpose of operating the marking device carried by the index-arm I provide an electromagnet 59 of peculiar construction, designed to take the place of the multiplicity of magnets for operating corresponding parts shown in the patent above referred to. This magnet 59 consists, among other parts, of two concentrically-curved laminated pole-pieces 60, between which is held a magnet-core 61, preferably of soft iron, by means of screws 62, passing through two uprights 63 of the supporting-frame 64, made fast to the base of the instrument. Wound on the core 61 is the exciting-coil 65 of the magnet. The upper edges of the pole-pieces 60 are capped by a preferably laminated piece 66, having a central filling 67, of lead or other suitable non-magnetic metal. This filling 67 is arranged in such a curve as to always be directly beneath the recording-point 15. By varying the width of the filling 67 the "air-gap" between the poles of the magnet may be varied—that is, the poles may be separated or brought more together, and thus so adjusted as to produce an absolutely uniform field throughout the travel of the armature 12. This is of great practical importance, since it makes it possible for the magnet to exert a straight downward pull on the recording-point without pulling it laterally, thereby greatly adding to the delicacy and accuracy of the instrument.

Located between the magnet 59 and the frame 31 is a clock mechanism 68 of any desired construction. Secured to the shaft 69 of the balance-wheel 70 of this clock mechanism is a delicate metallic strip 71, having at its free end a platinum contact 72. Located in the path of this contact 72 is a small platinum contact 73, mounted upon a yielding or resilient metal strip 74, secured at its lower end to an insulated support 75. The strip 71 is electrically connected to a binding-post 76, while the strip 74 is electrically connected to binding-post 77, as shown in dotted lines, Fig. 1. It will therefore be readily seen that as the balance-wheel shaft 69 oscillates back and forth, as is common in clock mechanism, the contact 72 will be brought into periodical engagement with the contact 73. Obviously there are many other ways of periodically bringing the contacts 72 and 73 into engagement by means of clock or other mechanism, any of which may be employed, if desired.

The binding-post 76 is electrically connected with instrument binding-post 78, so that when a source of current is connected between binding-posts 78 and 58 the periodic engagement of the contacts 72 and 73 will cause the periodic energization of magnet 57, the circuit passing from binding-post 78 to binding-post 76, balance-wheel shaft 69, strip 71, contact 72, contact 73, strip 74, binding-post 77, coil-magnet 57, back to the negative binding-post 58. The magnet 57 being thus energized will attract the armature 49 and cause the same to operate, through the arm 43 and pawl 42, the ratchet-wheel 41 thereby rotating the shaft 39 and through the gears 38, 36, and 35 the feed-rollers 25 and 26. The intervals at which the magnet 57 will attract the armature will of course depend upon the intervals at which the contact 72 is brought into engagement with contact 73. In this manner the paper may be fed forward under the recording-point at regular time intervals.

Each time the magnet 57 attracts its armature, as above described, contact 51 is brought into engagement with contact 52, and this completes a circuit which may be traced from the positive binding-post 78 through the coil 65 of magnet 59, frame 31, lever-arm 43, strip 50, contact 51, contact 52, spring 53, screw 54, back to the negative binding-post 58. Each time this latter circuit is completed the magnet 59 becomes energized and attracts the armature 12, bringing the recording-point into contact with the record-sheet. When the arm 43 returns to its initial position after the magnet 57 has become deenergized, the last-traced circuit is broken at points 51 and 52, thus deenergizing magnet 59 and allowing the recording-point to rise from the record-sheet. In this way a record is made upon the sheet 18, which may be substantially the same as that shown in the patent above referred to.



The resilient strips 50 and 53, or either of them, will permit the contact between points 51 and 52 when once made to be sustained for an appreciable time. The effect of this is twofold—first, it allows the force of the magnet acting on the armature 12 to act for a longer time at each pull than would be the case if the contact between the points 51 and 52 were instantaneous. Therefore with the same amount of current to operate the magnet 59 a greater pull may be exerted on the armature 12. The second effect above referred to is to more securely establish the electrical continuity between the contacts 51 and 52.

Owing to the resiliency of the extension 11, the recording-point will leave the record-sheet immediately after the deenergization of the magnet 59, thus insuring the least amount of resistance to its angular movements.

It will be observed that when the armature 12 is attracted, this may pull down the index-arm 5 slightly; but its downward motion will be limited by the strip 8, while the downward motion of the recording-point may continue until stopped by engagement with the record-sheet.

The top of the instrument-casing is provided with an opening 79, having a glass cover, which permits the record-sheet to be read from the outside of the instrument. This arrangement also permits the movements of the recording-point and arm to be observed without removing the instrument-cover.

What I claim is—

1. A recording instrument, comprising an angularly-movable index-arm, a marking device carried by said arm, and an electromagnet for operating said marking device, said magnet comprising two concentrically-curved pole-pieces, a core of magnetic metal connecting the two, a magnet-coil on said core, and a central filling of non-magnetic material inserted in the "air-gap" between said pole-pieces and extending in a curve to conform to the path of travel of the point of the marking device.

2. A recording instrument, comprising an angularly-movable index-arm, a marking device carried by said arm, and an electromagnet for operating said marking device, said magnet comprising two concentrically-curved laminated pole-pieces, a core of magnetic metal connecting the two, a magnet-coil on said core, and a curved pole face-piece over the upper edges of said concentric pole-pieces consisting of laminated magnetic metal with a central filling of non-magnetic material the latter extending in a curve to conform to the path of the travel of the point of the marking device.

3. A recording instrument, comprising an angularly-movable index-arm, a marking device carried by said arm, an electromagnet to operate said marking device, record-sheet-

feeding mechanism, electrical contacts operated thereby and controlling the operation of said magnet, an electromagnet to operate said mechanism, and a periodic contact device to control the operation of said last-named magnet.

4. A recording instrument, comprising an angularly-movable index-arm, a marking device carried thereby, an electromagnet to operate said marking device, record-sheet feed-rollers, ratchet-and-pawl mechanism to operate said feed-rollers, an electromagnet to operate said mechanism, electrical contacts in circuit with the coils of the feed-roller-operating magnet, independent periodically-acting means to make and break the electrical continuity between said contacts, and contacts operated by said last-named magnet to periodically connect in an electric circuit the coils of the electromagnet which operates the marking device.

5. A recording instrument, comprising an angularly-movable index-arm, a marking device carried thereby, an electromagnet to operate said marking device, record-sheet feed-rollers, ratchet-and-pawl mechanism to operate said feed-rollers, an electromagnet to operate said mechanism, a yielding electric contact device also operated by said last-named electromagnet to control the operation of the first-mentioned magnet, clock mechanism, and a periodic contact device operated thereby to control the operation of the paper-feed-operating magnet.

6. A recording instrument, comprising a magnet having juxtaposed pole-pieces with an "air-gap" therebetween, means to vary said "air-gap" to produce a uniform field, and recording means operated by said magnet.

7. A recording instrument, comprising a magnet having juxtaposed pole-pieces with an "air-gap" therebetween, a non-magnetic filling in said "air-gap," an armature movable in proximity to said pole-pieces over said "air-gap," and a recording device operatively connected to said armature.

8. A recording instrument, comprising a magnet having juxtaposed pole-pieces curved to form two substantially concentric arcs with an "air-gap" therebetween, non-magnetic material inserted in and spanning said "air-gap," and recording means operated by said magnet.

9. A recording instrument, comprising a magnet having juxtaposed pole-pieces, an armature mounted to travel laterally of said pole-pieces in proximity to the same, and also in a direction substantially at right angles to the said lateral travel, the said magnet being adapted to exert a pull on the said armature to move it in the latter direction, means to equalize the said pull of said magnet on the armature to prevent the same from being pulled unequally laterally by said magnet,



means independent of said magnet to impart said lateral travel to said armature, and recording means operatively connected to said armature.

- 5 10. A recording instrument, comprising a magnet having elongated juxtaposed pole-pieces with an "air-gap" therebetween, an armature mounted to travel laterally of said elongated pole-pieces in proximity thereto  
10 and vertically with respect to the pole-faces thereof, the said magnet being adapted to exert a pull on said armature to move it in the latter direction, means independent of said magnet to impart said lateral movement to  
15 said armature, means to regulate said "air-gap" to produce a uniform field along the lateral travel of said armature, whereby the said pull on said armature by the magnet will be equalized, and recording means operatively  
20 connected to said armature.

11. A recording instrument comprising a

magnet-core, pole-pieces secured to opposite ends of said core and comprising two segmental plates curved to form two substantially concentric arcs, said plates extending 25 above said core, and to opposite sides thereof to form lateral wings, each of said plates having a lateral inwardly-extending projection and therebetween an elongated "air-gap," non-magnetic material inserted and spanning 30 said "air-gap," an armature movable in proximity to said magnet laterally of the pole-pieces thereof and also in a direction substantially at right angles to said movement, and recording means operatively connected to 35 said armature.

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

CHARLES E. VAWTER, JR.

Witnesses:

WALLER B. ELLETT,  
CHAS. L. PEDIGO.