(No Model.) 4 Sheets—Sheet 1.

H. J. HAIGHT.

MULTIPLE CIRCUIT CLOSER.

No. 442,882. Patented Dec. 16, 1890.

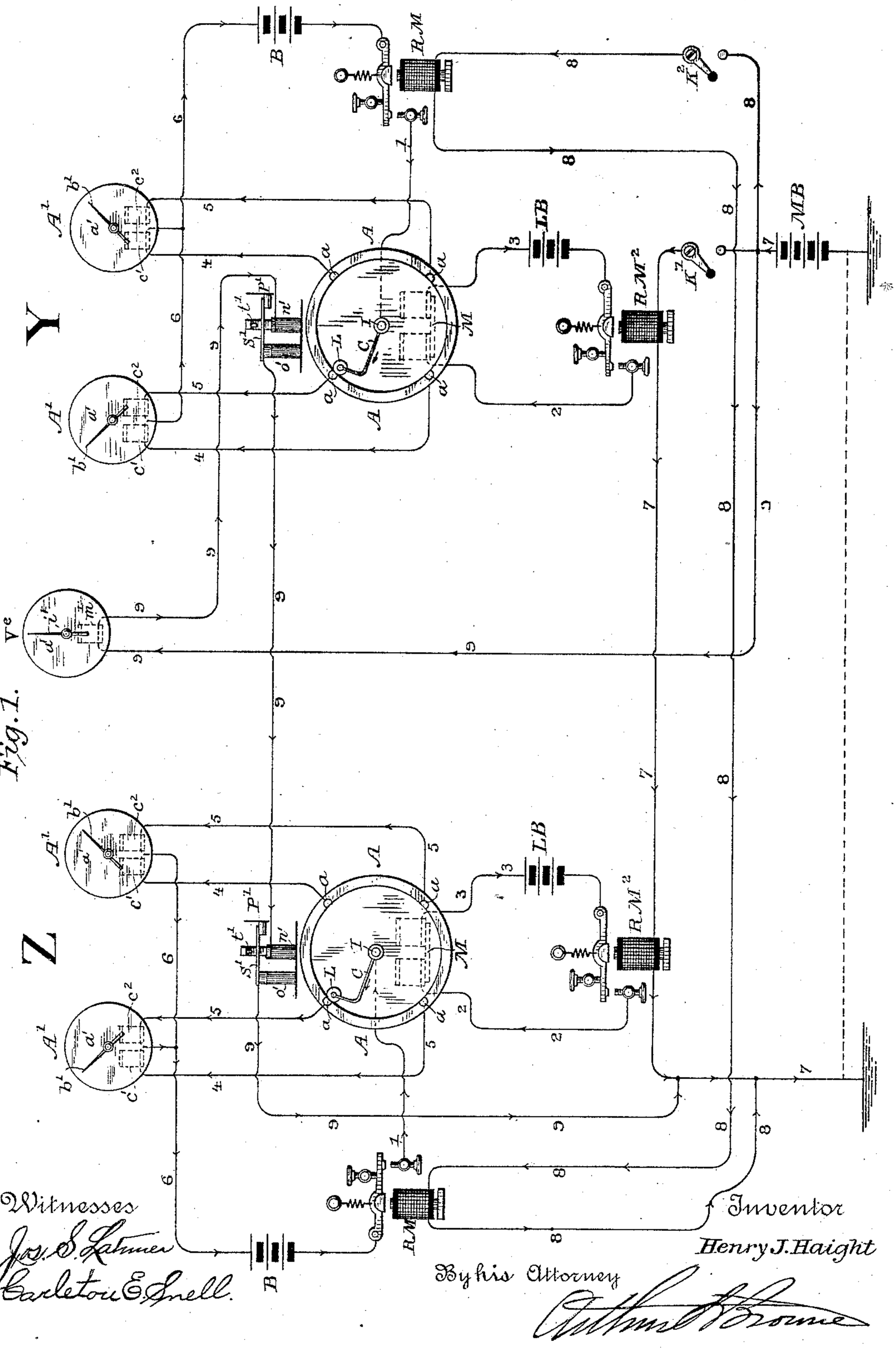

Fig. 1.

Witnesses
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Inventor
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By his Attorney
Edmund Browne

(No Model.)

4 Sheets—Sheet 2.

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MULTIPLE CIRCUIT CLOSER.

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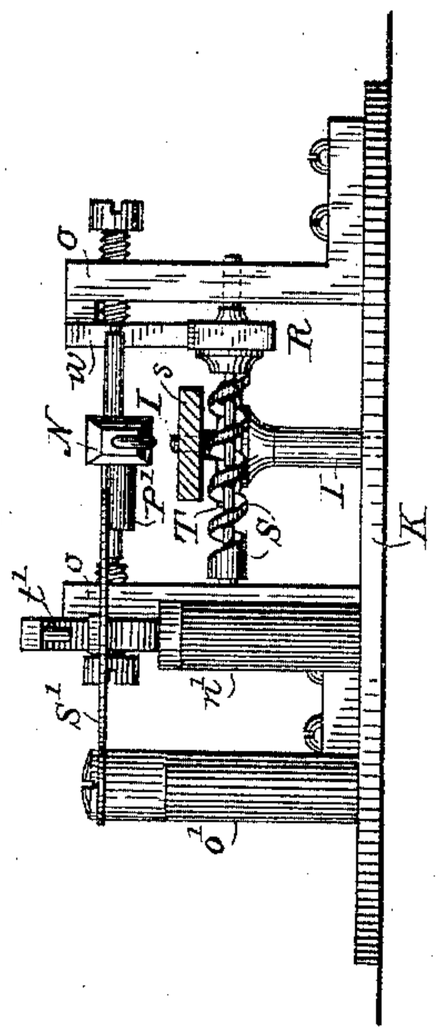
Fig. 1.



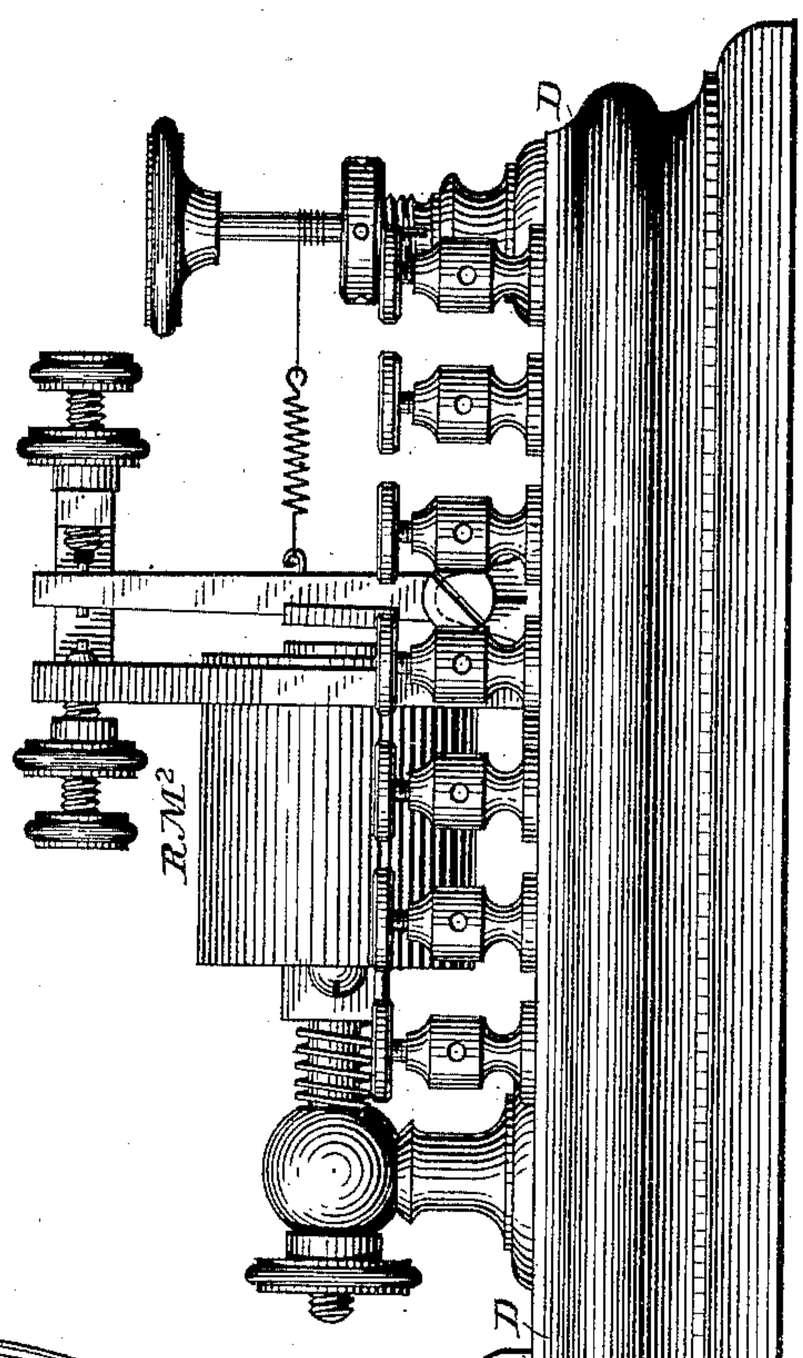
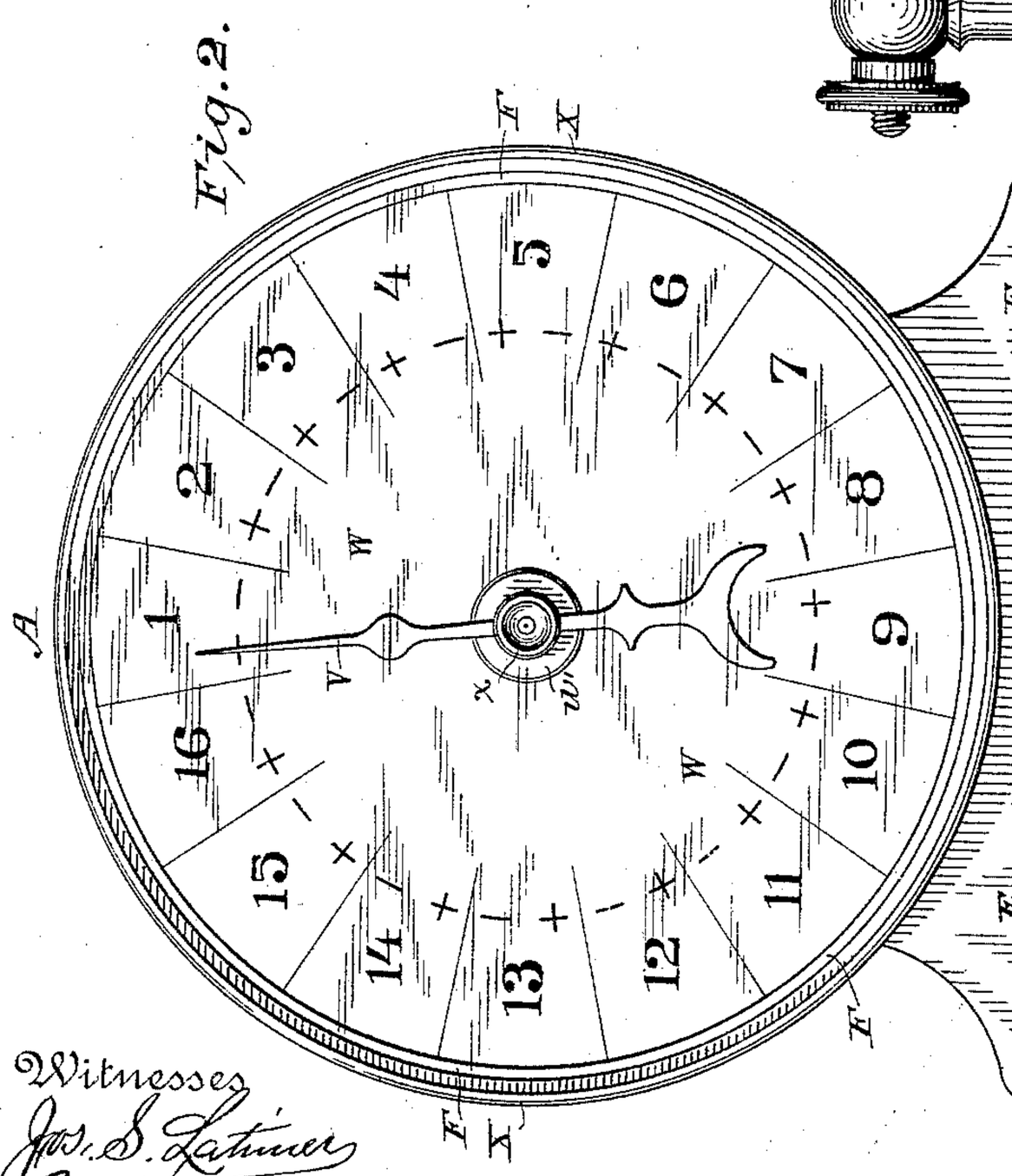


Fig. 2.



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4 Sheets—Sheet 3.

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MULTIPLE CIRCUIT CLOSER.

No. 442,882. Patented Dec. 16, 1890.

Fig. 3.

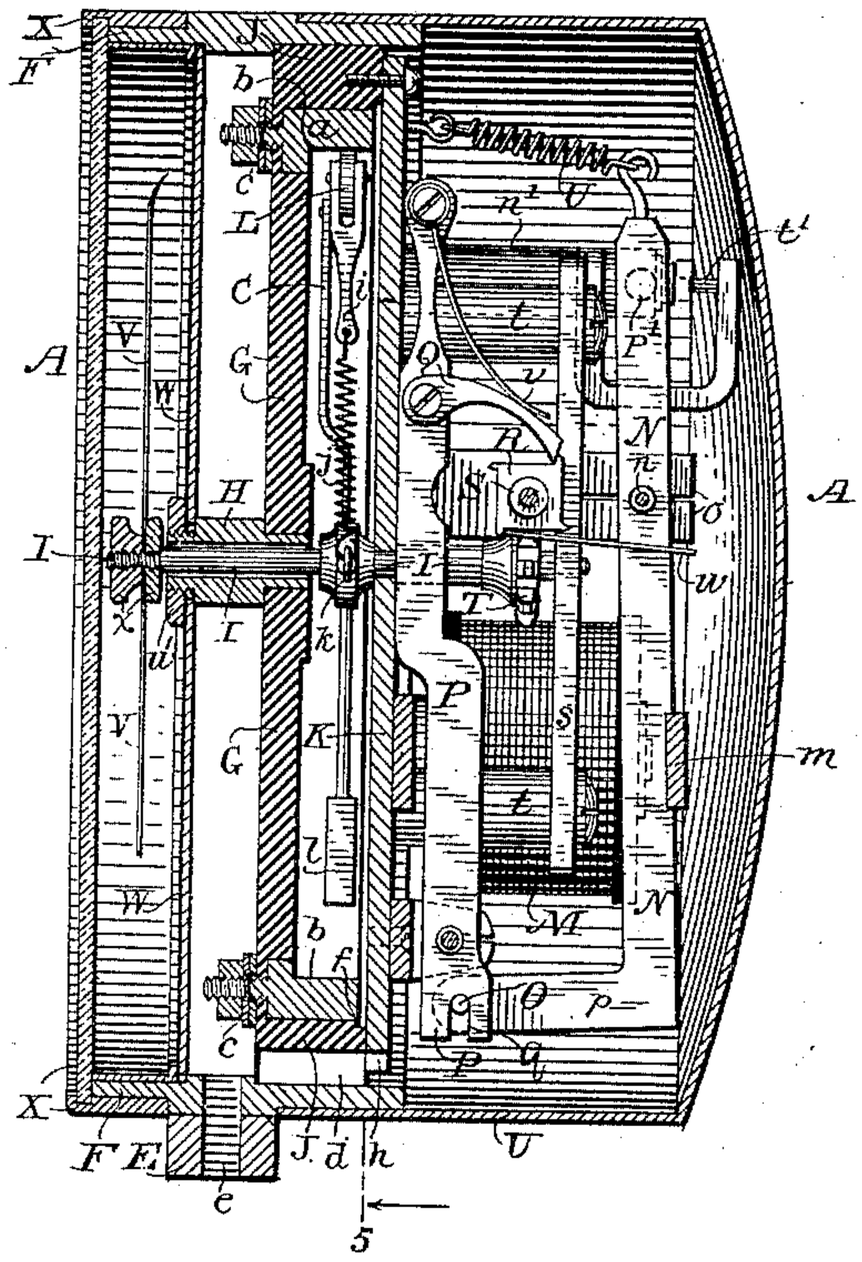
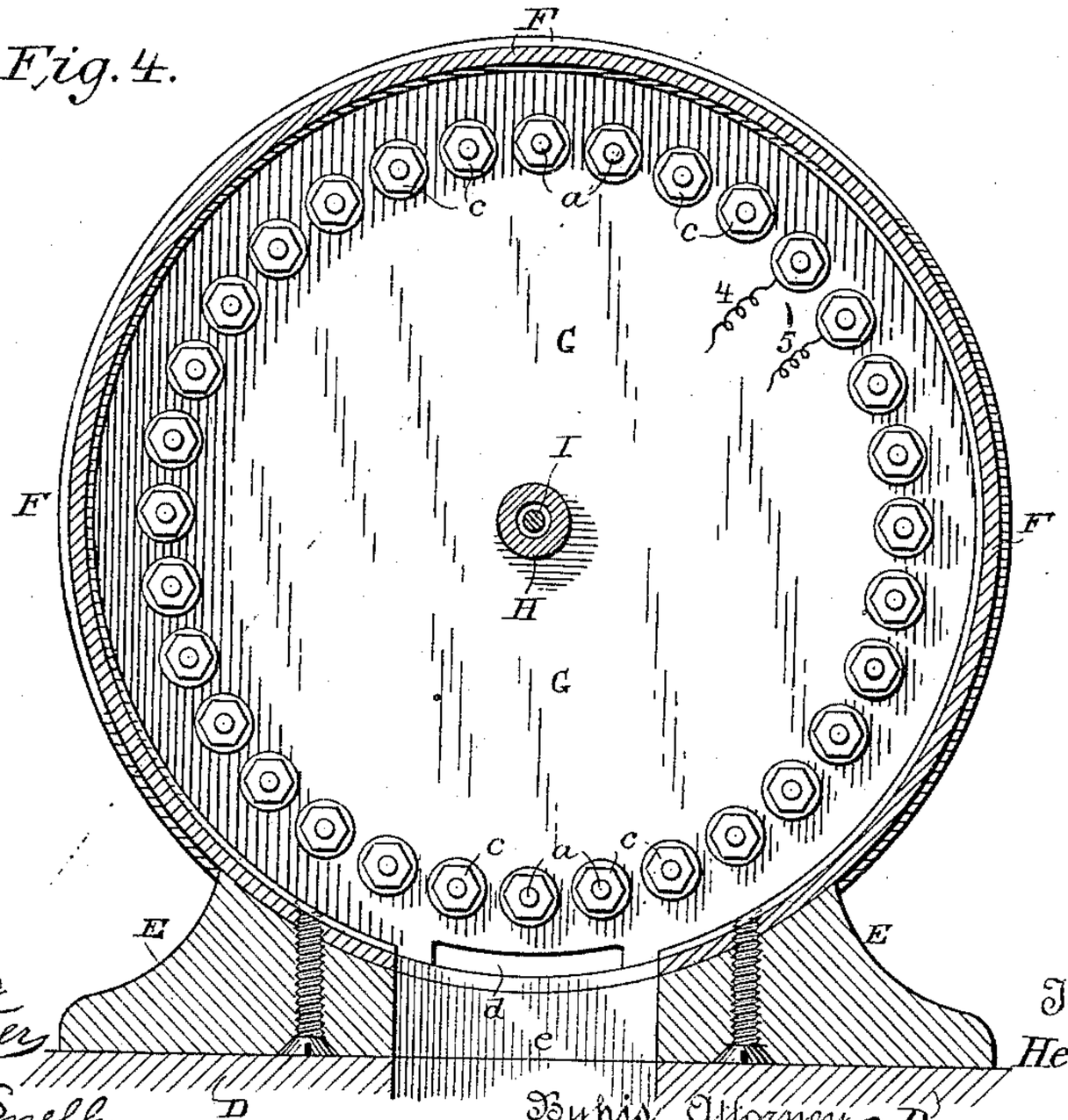


Fig. 4.



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(No Model.)

4 Sheets—Sheet 4.

H. J. HAIGHT.

MULTIPLE CIRCUIT CLOSER.

No. 442,882. Patented Dec. 16, 1890.

Fig. 5.

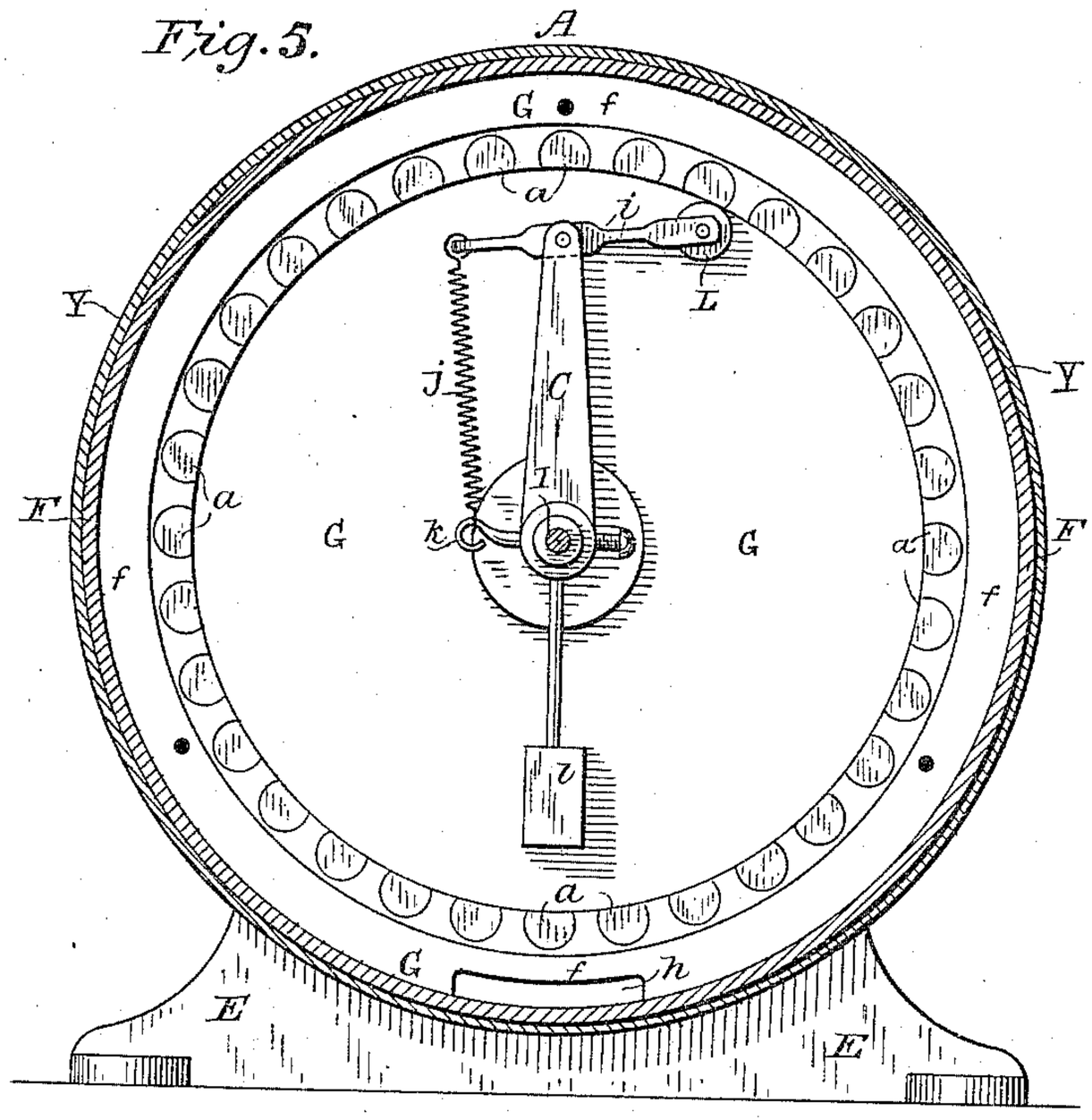
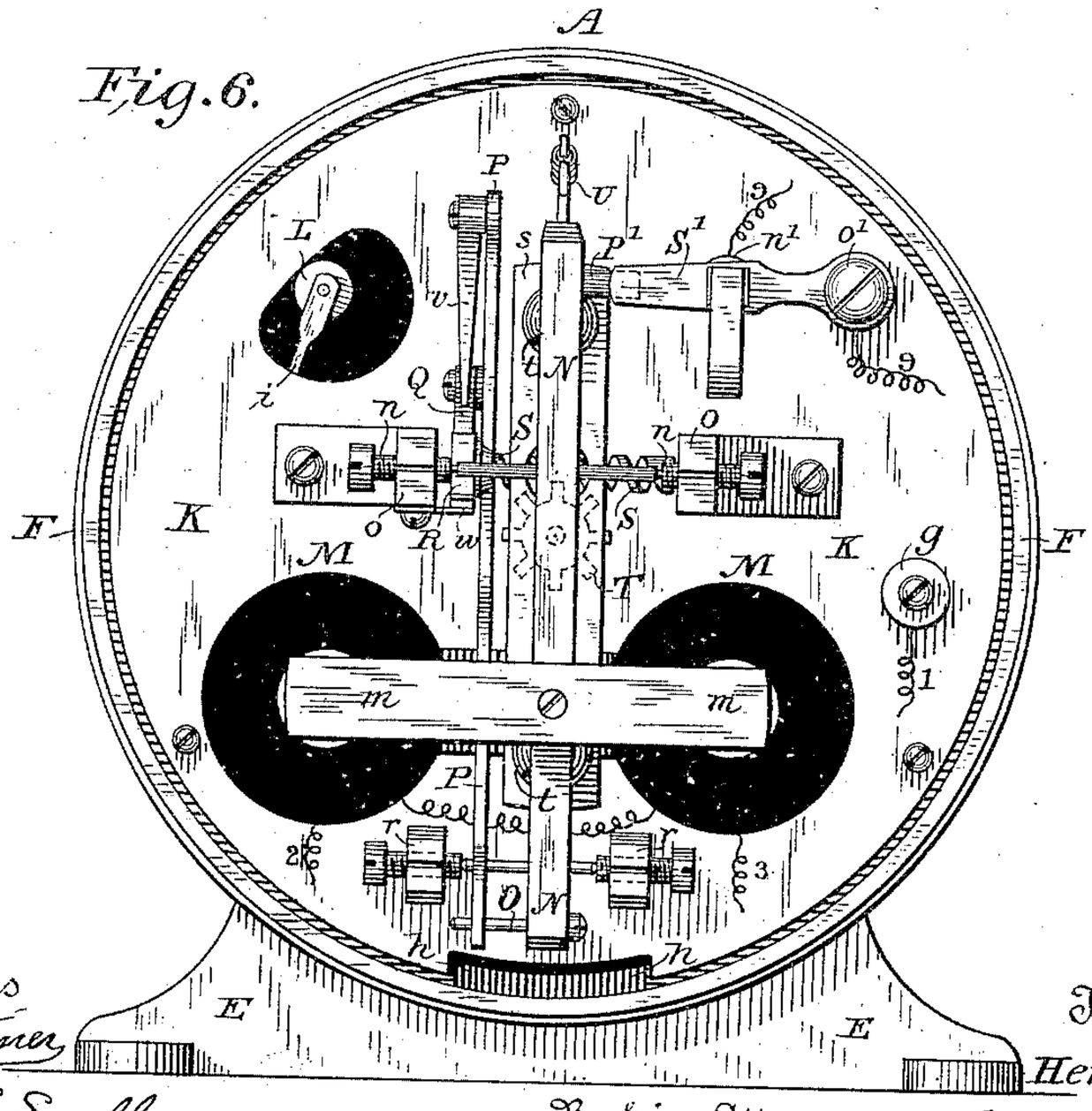


Fig. 6.



Witnesses
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Inventor
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By his Attorney
Arthur O'Brien

UNITED STATES PATENT OFFICE.

HENRY J. HAIGHT, OF NEW YORK, N. Y.

MULTIPLE-CIRCUIT CLOSER.

SPECIFICATION forming part of Letters Patent No. 442,882, dated December 16, 1890.

Application filed March 14, 1890. Serial No. 343,842. (No model.)

To all whom it may concern:

Be it known that I, HENRY J. HAIGHT, of the city, county, and State of New York, have invented certain new and useful Improvements in Multiple-Circuit Closers, of which the following is a specification.

The present invention relates to devices or mechanisms which enable a plurality of electric indicating-instruments to be brought one by one into electrical communication with a single electric generator, whereby all of the indicating-instruments may be controlled by a single switch or key.

In a pending application for Letters Patent filed by me May 3, 1888, Serial No. 272,748, there is shown and described a system of indicating-instruments which are adapted to be brought successively into communication with a single electric generator by means of an instrument called a "multiple transmitter," which is in effect a circuit-director or multiple-circuit closer, since it enables a plurality of circuits to be closed one by one.

The present invention has for its object the production of a multiple-circuit closer or multiple transmitter, which can be used for all the purposes of the multiple transmitter set forth in said application, and which is much simpler in construction and operation; and the present invention consists in the improved and simplified construction of the multiple-circuit closer.

The improved instrument is illustrated in the accompanying drawings, in which—

Figure 1 is a diagram illustrating the manner of using the improved multiple-circuit closer, all of the instruments being shown diagrammatically and reduced to their simplest forms. Fig. 2 is a front view of the improved multiple-circuit closer. Fig. 3 is a vertical cross-section thereof. Fig. 4 is a vertical longitudinal section taken immediately behind the dial or indicating scale. Fig. 5 is a vertical longitudinal section in a plane indicated by the line 5 in Fig. 3. Fig. 6 is a rear view of the operating mechanism of the rotary circuit-closing arm, and Fig. 7 is a detail view.

In the drawings, A represents the multiple-circuit closer as a whole. This instrument includes as its primary and fundamental features a plurality of fixed insulated electrodes *a a*, and a rotary circuit-closing arm C, which is in permanent electric communication with one pole of an electric generator B, and which is given a step-by-step rotation, so as to come successively in contact with the several electrodes *a a* one by one.

In describing the invention the mechanical construction of the instrument A will be first set forth, and then subsequently the manner of its use in connection with the electric circuits.

On a suitable supporting-base D is secured a metallic bracket E, which supports a metallic ring or cylinder F, which in turn supports the operative mechanism of the multiple-circuit closer. Centrally secured to the cylinder F is a circular plate G, composed entirely of hard rubber or other equivalent insulating material. This plate is pierced at its center to receive and support a metallic sleeve H, through which passes the arbor I, on which the circuit-closing arm C is fastened. On its rear side the rubber plate G is formed at its periphery with a rearwardly-extending annular flange J, having its inner face *b* planed to a true circle concentric with the sleeve H and arbor I. In this flange the metallic electrodes *a a* are embedded, with their inner faces exposed and flush with the inner face *b* of the flange. The electrodes are thus insulated from each other and from all other parts of the instrument. These insulated electrodes are equidistant from each other and extend around the entire periphery of the flange J. The number of the electrodes depends upon the particular extent of use to which the instrument is to be put. The instrument may be made with any desired number. Thirty-two are shown in the particular instrument described, while four only are illustrated in the diagram, Fig. 1. Each insulated electrode *a* extends through the plate G, and is provided on the front side of the plate with a suitable binding-post *c* for the attachment of a circuit-wire 4 or 5. On its under side the ring or cylinder F is provided with a slot *d*, which registers with a passage *e*, formed in the bracket E and base D, through which extend all of the circuit-wires from the thirty-two binding-posts and all of the other circuit-wires connected with the instrument. The

rubber plate G is covered at the rear by a circular metallic plate K, which is secured by screws which tap into the flange J. The plate K seats against a raised annular bead *f* of the plate G, so that it is held out of electric contact with the several insulated electrodes *a a*. This metallic plate K carries on its outer face a binding-post *g*, to which is connected the circuit-wire *l*, which leads to one pole of the electric generator B. Consequently the plate K and all parts supported thereby (not otherwise insulated) are in electric connection with the generator B.

To enable all wires connected at the outer side of plate K to pass out through the passage *e* the plates K and G are formed with notches or slots *h* at their bottoms in the immediate vicinity of the slot *d* in the supporting ring or cylinder F. The metallic arbor I is journaled centrally in the plate K, so that it (with all metallic parts carried by it) is in constant electric communication with generator B. Owing to the projection of the flange J a space is left between the plates G and K for the reception and movement of the metallic circuit-closing arm C, which is rigidly secured to the arbor I, extending radially therefrom. Electric connection between the arm C and the insulated electrodes *a a* is made by means of a metallic trailing circuit-closing wheel L, which is rotatively mounted in the end of a metallic lever *i*, which is pivotally connected with the end of the arm C. The wheel L is held in proper frictional contact with the face *b* of the flange J and with the electrodes *a a*, irrespective of the radial position of the arm C, by means of a coiled spring *j*, which is attached at opposite ends to the inner end of lever *i* and to a hook *k*, secured to the arbor and extending at right angles to the arm C. Consequently as the arm C rotates the trailing friction-wheel is brought successively in contact one by one with the several insulated electrodes *a a*, thus bringing them one by one into electric connection with one pole of generator B. The arm C and the parts carried thereby are counterbalanced by a weight *l*.

As the object and purpose of the present improved multiple-circuit closer is to enable a plurality of electric circuits 4 5 to be brought one by one into communication with an electric generator, permitting each circuit to be maintained in such position for any desired length of time, it is essential that the arm C and its arbor I should be given a step-by-step movement and be adapted to rest an indefinite period at each step. The extent of each step is just sufficient to enable the trailing contact-wheel L to pass from one electrode *a* to the next in succession. Now this step-by-step movement is accomplished by means of the action of an operating electro-magnet M, carried by the plate K, and by mechanism intermediate between said magnet and said arbor I. This intermediate mechanism is as follows: The armature *m* of the magnet M is carried by a swinging armature-lever N, which rocks in suitable bearings *n n* on brackets *o o* secured to the rear side of plate K. The lower end (the words "lower" and "upper" and similar expressions being here used relatively only on the assumption that the instrument A is to be used in a vertical position) of the lever N is provided with an inwardly-extending horizontal arm *p*, carrying a laterally-projecting pin O, which rests and works in a vertical slot *q* in the short lower arm of a vertically-extending lever P, which is pivotally hung near its lower end between brackets *r r* on the plate K. To the long arm of the lever P, near its upper end, there is pivoted a pawl Q, which co-operates with a ratchet-wheel R on a horizontally-extending cross worm-shaft S, journaled in and between the brackets *o o* beneath the armature-lever N. The worm of the shaft S engages a spur-wheel T on the arbor I. The axis of the arbor I, it will be observed, is at right angles to that of the worm-shaft S. The outer end of the arbor I is journaled in a vertical bar *s*, which is rigidly supported at its opposite ends on posts *t t*, fixed to the plate K. Normally the armature-lever N is held (with the armature *m*) away from the magnet M by a retractile spring U, connected at opposite ends to the short arm of lever N and to the plate K, since the circuit in which magnet M is located is a normally open one. On the closing of this circuit the magnet-armature is attracted and the lower end of the armature-lever N, carrying pin O, is moved outward, thus swinging the long upper end of the lever P outward, and consequently causing the pawl Q to rotate the ratchet-wheel R one notch, and thereby rotate worm-shaft S, which in turn rotates the arbor and its circuit-closing arm C one step. The number of teeth on the ratchet-wheel R and spur-wheel T and the pitch of the worm on shaft S are properly proportioned with reference to the number of the electrodes *a*, so that the extent of each step of the arm C is just sufficient to cause the trailing contact-wheel L to pass from one electrode *a* to the next in succession. The reverse movement of the armature-lever N on the breaking of the circuit in which magnet M is located has no effect on the arm C. The arm C can thus be moved only by a making and breaking of the circuit in which the magnet M is located. A spring-detent *w*, secured to the adjacent bracket *o* and engaging ratchet-wheel R, prevents the backward rotation of the worm-shaft S. The pawl Q may be a gravity-pawl merely in case the instrument is always used in a vertical position. Otherwise it is kept in engagement with the ratchet-wheel by means of a spring *v*, fixed at one end to the upper end of lever P. The leading-in circuit-wire 2 and return-wire 3, connected to the magnet M, are carried out through the slots *h d* and passage *e*. All of the parts carried by the plate K are concealed and protected by a cover U, which fits over

the same and slips onto the rear of the ring or cylinder F.

To enable the position of the circuit-closing arm C to be known at all times, a visible index V is employed in connection with a circular dial or scale plate W. The circular dial or scale plate W is fitted in the front part of ring or cylinder F, inclosing and concealing the binding-posts *c c*, but held out of electric contact therewith by seating against a shoulder on the inner periphery of the cylinder F. The plate W has a central aperture fitting over the end of the sleeve H. The extreme outer end of this sleeve is screw-threaded, and the plate W is held in position by a nut *w'*, fitting on this screw-threaded end. The arbor I extends through the sleeve and projects in front thereof, the projecting end being screw-threaded. The index V is secured to the arbor I by means of binding-nuts *x*, fitting on the threaded end of the arbor I. The dial is graduated with proper readings to indicate the several positions to which the index may be moved. The dial and index are inclosed and protected by a cap X with a glass front, which slips onto the front of the ring or cylinder F.

This multiple-circuit closer as thus described can be used for any purpose where it is desired to bring a plurality of circuits into successive operative relation with a single generator. It is particularly designed, however, for use in a system for the inter-transmission between a plurality of stations of information which is capable of interpretation through index movements. Such a system is set forth in my aforesaid pending application, Serial No. 272,748, and the present improved multiple-circuit closer is employed as a substitute for the instrument therein termed a "multiple transmitter." However, to enable the use of the improved instrument to be understood without reference to said application, the diagram, Fig. 1, is introduced. In this diagram the instruments A are illustrated conventionally only and in their simplest forms. Each instrument A is shown with but four electrodes *a a*, and none of the intermediate mechanism between the actuating-magnets M and the circuit-closer C is illustrated. In this diagram there are shown two stations Y Z only, the station Y being a transmitting-station and the station Z a receiving-station. Any number of stations, however, can be included, and each may be both a transmitting-station and a receiving-station. The extension of the system is within the knowledge of any competent electrician, and hence is not considered essential to be herein set forth.

At each station there is located one of the multiple-circuit closers. In connection with the multiple-circuit closer there are employed a plurality of electric indicating-instruments A' A' of any well-known character. Each of these electric indicating-instruments comprises, as usual, a properly-graduated dial *a'* and a movable index *b'*, capable of a step-by-step movement in either direction. The graduations of the dials correspond with the character of information desired to be indicated, such as stock quotations, meteorological records, and the like. The index *b'* is moved through well-known mechanism by the excitation of two electro-magnets *c' c²*, the excitation of one magnet, as *c'*, moving the index forward, and the excitation of the other magnet moving the index backward. The magnets *c' c²* of all the indicating-instruments at each station are separately connected by circuit-wires 4 5 with the several electrodes *a a*, respectively, of the multiple-circuit closer A. All of the magnets *c' c²* of all the instruments at one station are connected by a single return-wire 6 to the pole of the generator B opposite to that to which the wire 1 is connected. The indicating-instruments are thus arranged in multiple. There are, therefore, at each station one-half as many electric indicating-instruments A' as there are electrodes *a*. By the action of the circuit-closing arm C any one of the magnets *c' c²* of any one of the instruments A' may be brought into circuit with the generator B, depending upon the particular information which is to be indicated and the direction in which the index *b'* is to be moved. When the proper magnet *c'* or *c²* of the proper instrument is thus in circuit, the proper index *b'* is moved as many steps as is necessary by breaking or making the circuit through generator B by means independent of the multiple-circuit closer, which may be conveniently a relay-magnet RM, controlling a break either in circuit-wire 1 or in circuit-wire 6. Now, in order that information can be transmitted from one station to another it is first essential that the circuit-closers CC of the several multiple-circuit closers should move in unison. To this end the circuit-wires 2 3 of each operating-magnet M connect, preferably, with opposite poles of a local generator LB, and the action of the magnet M is controlled by means of a relay-magnet RM², controlling a break in the local circuit 2 3.

To secure unison of action in the several multiple-circuit closers, the relay-magnets RM² at the several stations are connected in series by a line-circuit 7, in which is included a main generator MB, and which is controlled by a hand-switch or key K'. The main circuit 7 is normally an open one. By closing it through switch or key K' the relay-magnets RM² are simultaneously operated, thus simultaneously closing the several local circuits through the operating-magnets M, and consequently moving the several arms C in unison. Hence after the first installation of the system corresponding instruments A' at the several stations are always in circuit simultaneously. Then in order to operate the indices *b'* of corresponding indicating-instruments A' at the several stations in unison, the several relay-magnets RM of the several sta-

tions are connected in series by a line-circuit 8, (which may extend through generator MB.) The circuit 8 is controlled by a hand-switch or key K^2, the manipulation of which actuates the relay-magnets RM simultaneously, thus actuating in unison the particular instruments A′ A′ at the several stations which have been brought into circuit by the action of the multiple-circuit closers. This system of electric-circuit connections is in all substantial respects the same as that described in my application above named, and no claim is here based thereon.

The relay-magnet RM^2 is shown in Fig. 2 on the same supporting-base D as the multiple-circuit closer A. On the same base, also, are mounted the binding-posts for the several line and battery wires. All the wires leading into the case of instrument A are properly insulated, so that there may be no short-circuiting. It will be observed that the relative arrangements of the electrodes *a a* and of the circuit-closing arm C is characteristically different from that of the corresponding parts in said application. In the present case the electrodes are arranged in a circle having the arbor I as the center, and the contact-surface of each electrode is perpendicular to a radius of the circle and consequently perpendicular to the circuit-closing arm. As a result of this arrangement, the contact between the trailing contact wheel or brush and the electrodes is at all times perfect and is maintained uniformly and with no tendency to a disarrangement of the parts.

The present invention also includes means for determining at the transmitting-station whether or not the multiple-circuit closers A A at the receiving-stations are operating in unison with that at the transmitting-station. My application, Serial No. 272,748, for Letters Patent, above named, shows verifying means for this purpose, so that as far as the present case is concerned the invention resides as to this feature in the particular means employed. Adjacent to the short arm of the armature-lever N of each multiple-circuit closer A the metallic plate K carries two posts *n′ o′* of insulating material. To one of these posts *o′* most remote from the lever N is attached one end of a spring-contact S′, the free end of which is normally out of contact with a metallic electrode *t′*, supported by the other post *n′* above the spring-contact. The free end of spring-contact S′ normally rests upon (or just above) a pin P′ of insulating material projecting laterally from the short arm of the armature-lever N. When now the long arm of armature-lever N is depressed by reason of the excitation of magnet M, the pin P′ is elevated, thus bringing the spring-contact S′ into electric communication with electrode *t′* and thus closing an electric circuit, as will presently appear.

The verifier *Ve*, which is located at the transmitting-station in convenient proximity to the multiple-circuit closer, may be a duplicate of the multiple-circuit closer or substantially similar to one of the indicating-instruments A′. It comprises a scale or dial *a′*, graduated to correspond with the graduations of the multiple-circuit closer, an index *i′*, having a step-by-step movement, and a single actuating electro-magnet *m′*, (since the index is to be moved in one direction only,) which operates the index through any well-known intervening mechanism. The verifier-magnet *m′* is located in an electric circuit 9, which extends to all of the multiple-circuit closers in the system in series, and which is normally broken at each multiple-circuit closer by the breaks between the several spring-contacts S′ and their respective electrodes *t′*. The spring-contact S′ of one multiple-circuit closer is connected with the electrode *t′* of the next multiple-circuit closer in the series, as is shown in the diagram, Fig. 1. Now it is evident that the circuit 9 through the verifier-magnet can be closed so as to operate its index only by the simultaneous action of all the multiple-circuit closers in the series. If any one fails to act for any reason, the circuit will not be closed and the verifier will fail to register with the multiple-circuit closer at the transmitting-station. Hence after the instruments have been placed in unison at the first installation of the system any subsequent divergence between the verifier and the multiple-circuit closer at the transmitting-station shows that the system is not working properly, and the proper steps for correction can be taken.

My aforesaid application, Serial No. 272,748, shows a verifier in a circuit which is normally broken at each multiple-circuit closer, and which is actuated only by the simultaneous action of all of the multiple-circuit closers in the series, so that no claim is here made to the system of verification. I only claim now the special means for closing the circuit.

I claim as my invention—

1. The dial-plate W, carrying on its exterior face a dial or scale, the rear supporting-plate K, and the plate G intermediate between said plates W and K, said three plates being parallel with each other, with spaces between them, and a rotary arbor or shaft extending through said three plates perpendicularly thereto, in combination with an annular ring or flange J, of insulating material, carried by said plate G, a plurality of insulated electrodes separated from each other and carried by said flange between the plates G and K, said electrodes having their contact-faces concentric with said arbor, a circuit-closing arm carried by said arbor, moving between said plates G and K, and co-operating with said electrodes, the operating mechanism for said arbor, carried by said plate K on its exterior, a plurality of circuit-wires connected with said electrodes and occupying the space between said plates G and W, and an index carried by said arbor exterior to the plate W, substantially as set forth.

2. The base D, bracket E, mounted thereon, and the supporting ring or cylinder F, said base, bracket, and ring or cylinder having a slot or passage-way *d e* extending therethrough and establishing communication between the interior of the way and the bottom of the base, and the central intermediate plate G, supported within said ring or cylinder F, and having an annular rim or flange J, of insulating material, on its rear side, in combination with a front dial-plate W within said ring or cylinder F, there being a space between said plates W and G communicating with said passage-way *d e*, a rear plate K within said ring or cylinder F and behind said plate G, there being a space between said plates G and K, a rotary arbor extending through said plates G K W perpendicularly thereto, mechanism for operating said arbor, carried by said rear plate K on its rear side, a plurality of insulated and separated electrodes carried by said flange J between said plates G and K, the contact-surfaces of said electrodes being concentric with said arbor, a circuit-closing arm carried by said shaft between said plates G and K and co-operating with said electrodes, a plurality of electric-circuit wires connected with said electrodes, respectively occupying the space between said plates G and W and extending outward through said passage-way *d e*, and an index carried by said arbor exterior to said dial-plate W, substantially as set forth.

3. A rotary arbor, a plurality of insulated electrodes the contact-surfaces of which are in a circle having said arbor as its center, the contact-surface of each electrode being perpendicular to a radius of said circle, an electric generator, a plurality of electric indicating-instruments arranged in multiple, all being in electric communication with one pole of said generator, and a plurality of electric-circuit wires, each wire connecting one of said indicating-instruments with one of said electrodes, in combination with a circuit-closing arm carried by said arbor and adapted to make contact with said electrodes in succession, said circuit-closing arm being in electric communication with the opposite pole of said electric generator, substantially as set forth.

4. A rotary arbor, a circuit-closing arm carried thereby, a spur-wheel on said arbor, a worm-shaft engaging said spur-wheel, and a ratchet-wheel on said shaft, in combination with an electro-magnet, a pivoted armature-lever, the armature of said magnet carried by said lever, a retractile spring acting on said armature to retract the same from its magnet, a pivoted lever P, a pawl pivoted to one end of said lever P and co-operating with said ratchet-wheel, said lever P having a slot in its other end, and a pin carried by said armature-lever and entering the slot in said lever P, substantially as set forth.

5. The base D and bracket E, having a slot or passage-way *e* extending therethrough, and the supporting ring or cylinder F, having a slot *d* communicating with said passage-way *e*, in combination with the plate G, of insulating material, fixed within said ring or cylinder, and a plurality of electrodes supported by said plate, each electrode having means for the attachment of a circuit-wire, all of said circuit-wires being led out through said slot *d* and passage-way *e*, substantially as set forth.

6. The supporting ring or cylinder F, the plate G, of insulating material, fitted within said ring or cylinder, said plate having a projecting annular peripheral flange J, and a plurality of electrodes secured to said flange, with their contact-faces exposed on the inner face of said flange, in combination with a plate K, fitted within said ring or cylinder parallel with said plate G and next to the flange J, whereby a circular space is formed between the plates G K, encircled by the flange J, a rotary arbor journaled in said plate K, and a circuit-closing arm carried by said arbor between said plates K and G, substantially as set forth.

7. The supporting ring or cylinder F and the plate K fitted therein, in combination with the rotary arbor journaled in said plate, the circuit-closing arm carried thereby, the actuating mechanism of said arbor mounted on said plate, and a cover slipping onto said cylinder F and inclosing and concealing the plate K and all parts carried thereby, substantially as set forth.

8. The supporting ring or cylinder F, having a slot *d* for the passage of circuit-wires, in combination with the plates G and K, having slots *h* for the passage of circuit-wires connected with the plate K or with parts mounted thereon, substantially as set forth.

9. The plate K, the rotary arbor journaled therein, the electro-magnet supported by said plate, the movable armature-lever N, and mechanism intermediate between said lever and arbor for rotating said arbor, in combination with two posts *n' o'*, carried by said plate, a spring-contact S', carried by the post *o'*, a fixed electrode *t'*, carried by the post *n'*, with which said spring-contact is normally out of contact, a pin P', carried by said armature-lever N and co-operating with said spring-contact to bring the same in contact with said electrode on the excitation of said electro-magnet, and an electric circuit including an electric generator, said circuit including said spring-contact and said electrode, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HENRY J. HAIGHT.

Witnesses:
ARTHUR H. BROWNE,
GEO. R. BYINGTON.