(No Model.) 6 Sheets—Sheet 1.

H. J. HAIGHT.

ELECTRICAL INDICATOR.

No. 492,011. Patented Feb. 21, 1893

Fig. 1.

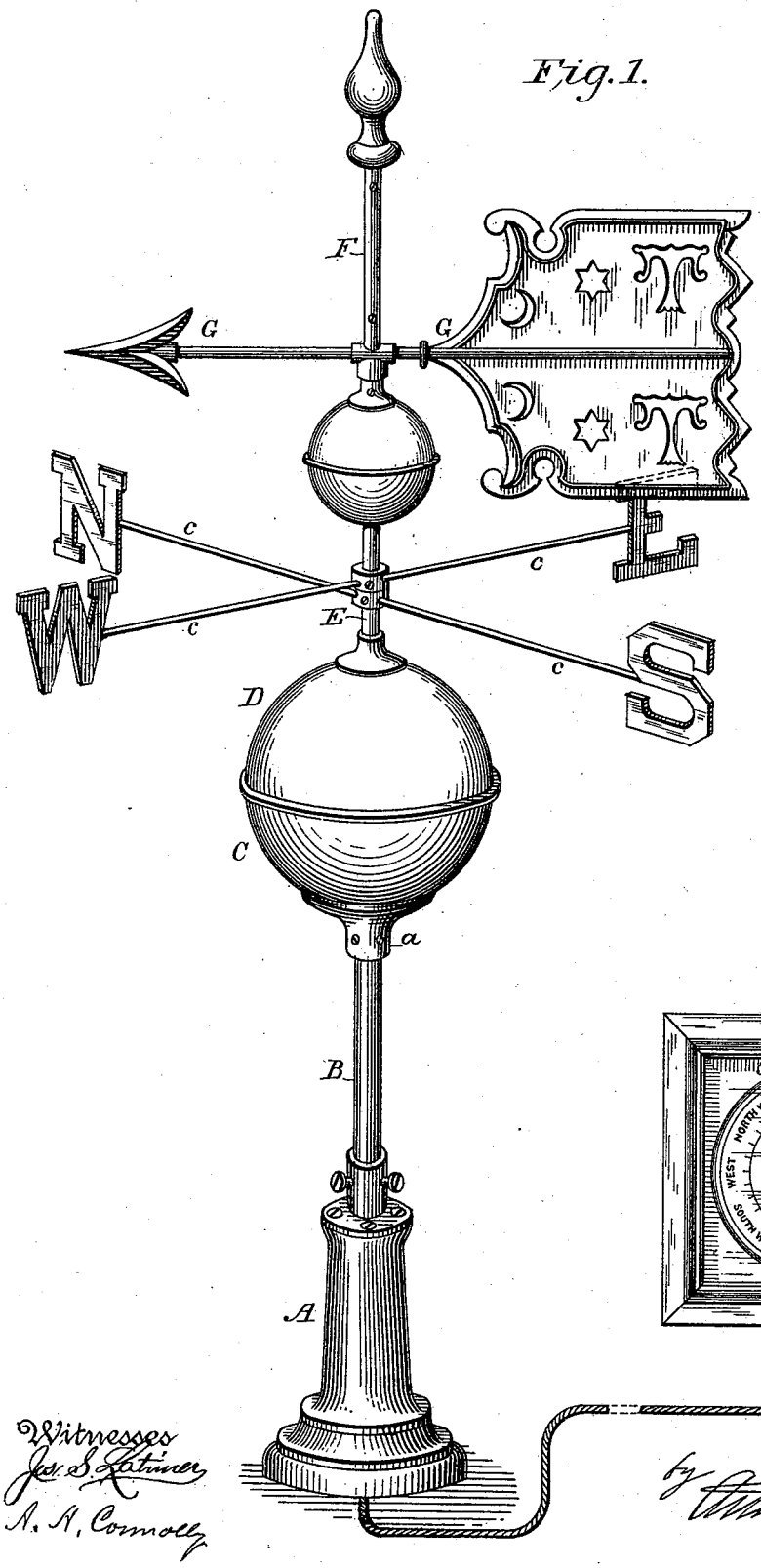
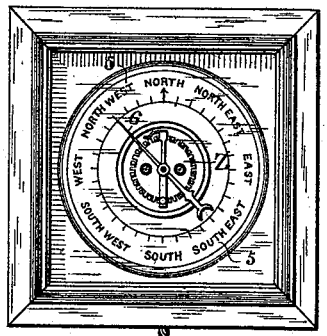


Fig. 9.



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(No Model.) 6 Sheets—Sheet 2.

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ELECTRICAL INDICATOR.

No. 492,011. Patented Feb. 21, 1893.

Fig. 2.

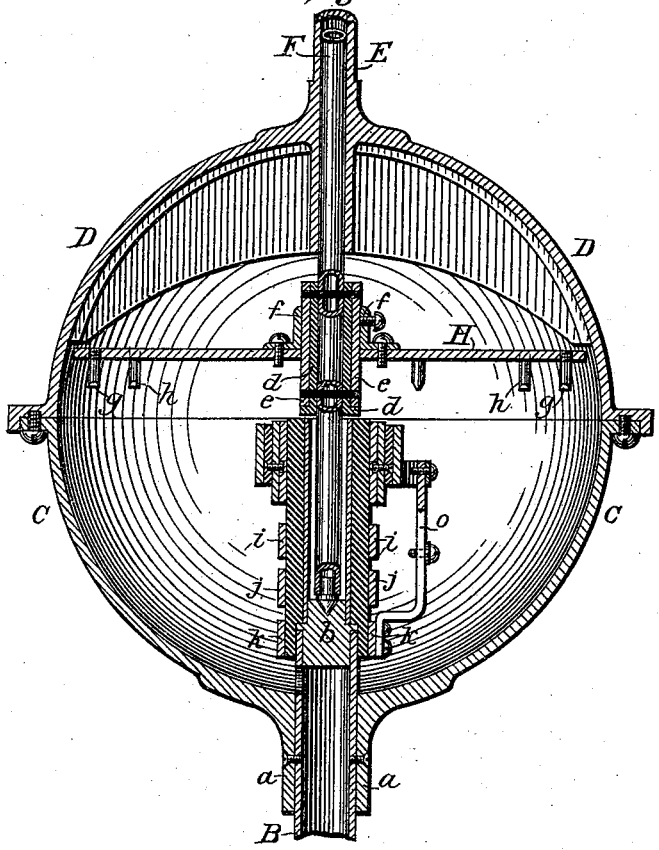
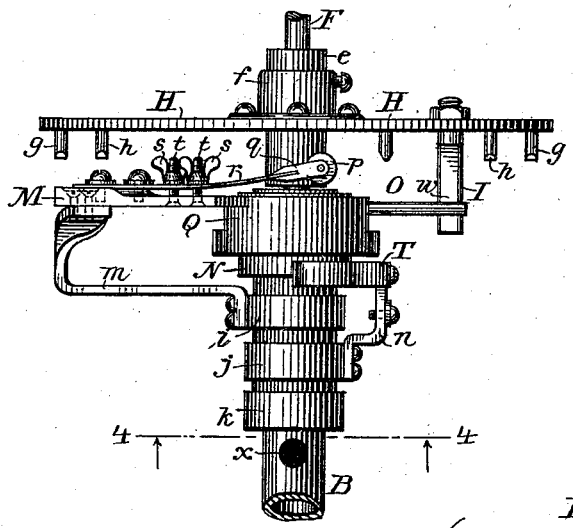


Fig. 3.



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(No Model.) 6 Sheets—Sheet 3.

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ELECTRICAL INDICATOR.

No. 492,011. Patented Feb. 21, 1893.

Fig. 4.

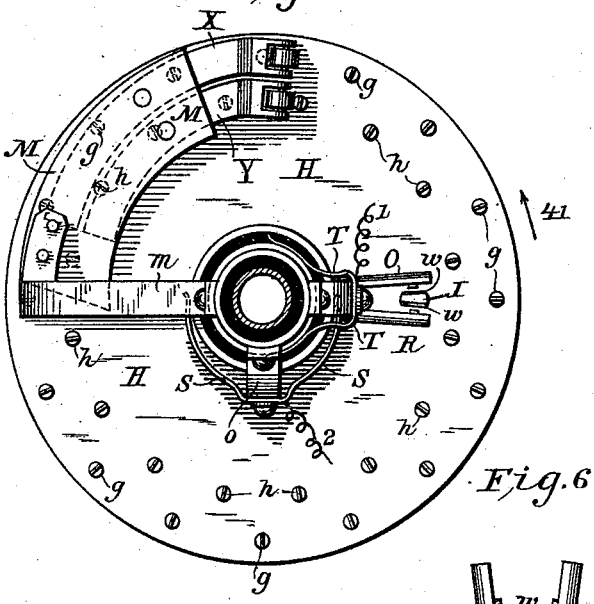


Fig. 8.

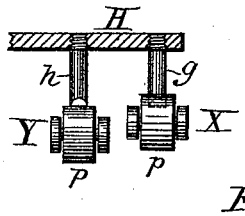


Fig. 6.

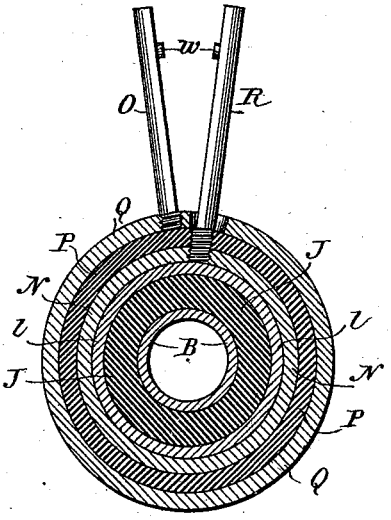


Fig. 5.

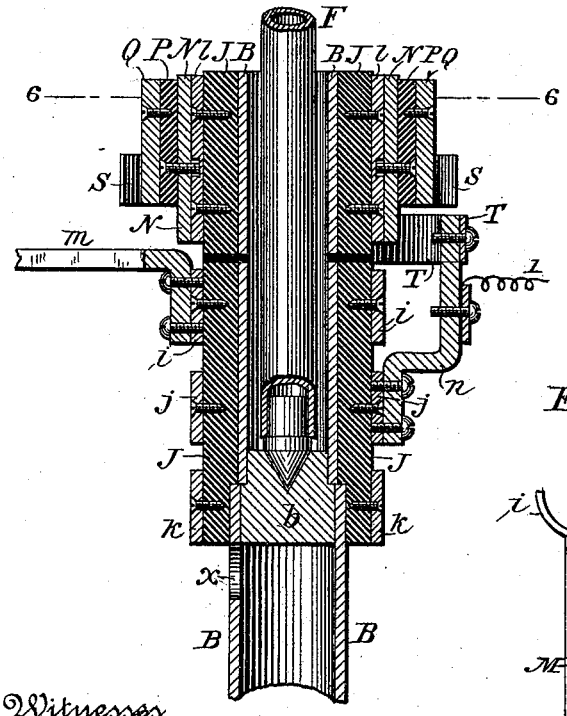
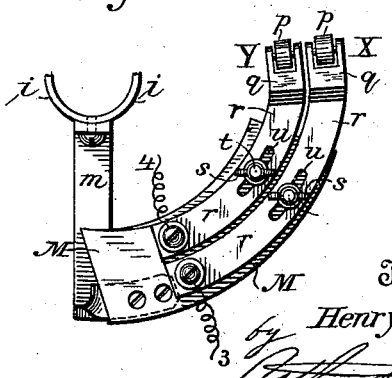


Fig. 7.



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(No Model.) 6 Sheets—Sheet 4.

H. J. HAIGHT.

ELECTRICAL INDICATOR.

No. 492,011. Patented Feb. 21, 1893.

Fig. 10.

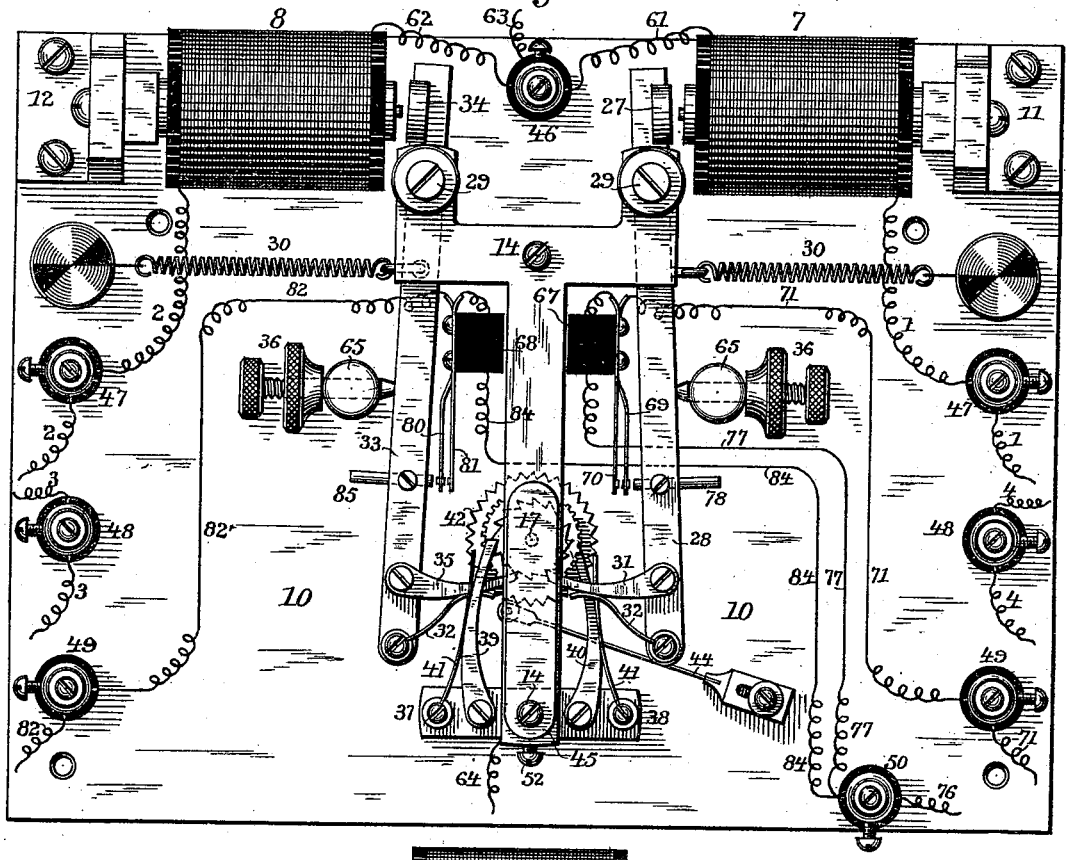


Fig. 13.

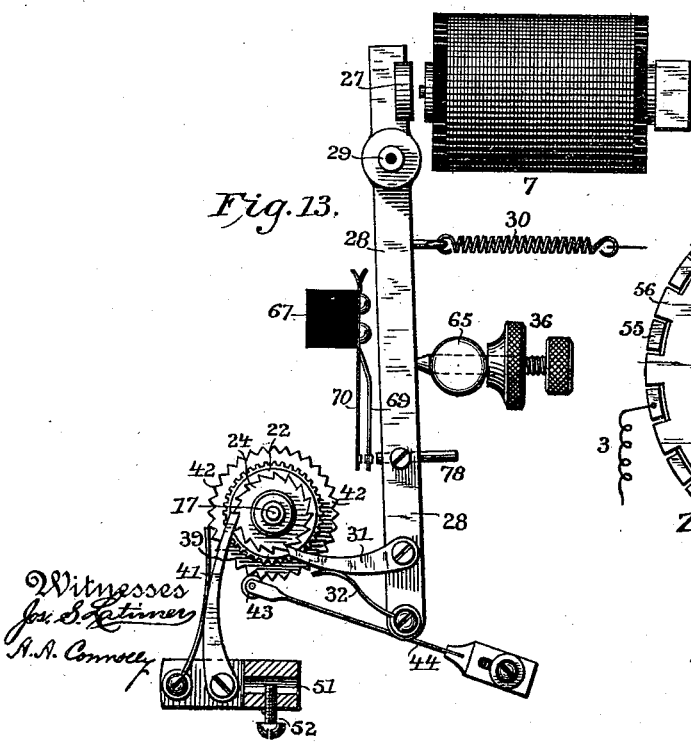
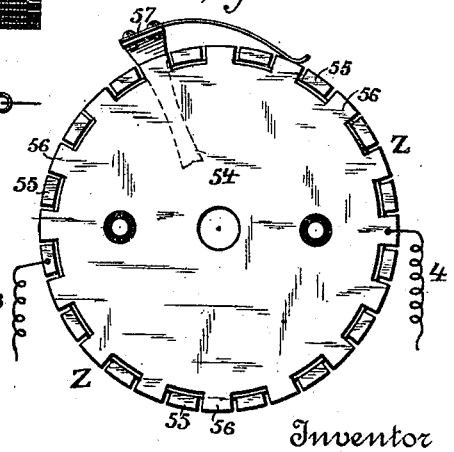


Fig. 14.



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(No Model.) 6 Sheets—Sheet 5.

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ELECTRICAL INDICATOR.

No. 492,011. Patented Feb. 21, 1893.

Fig. 11.

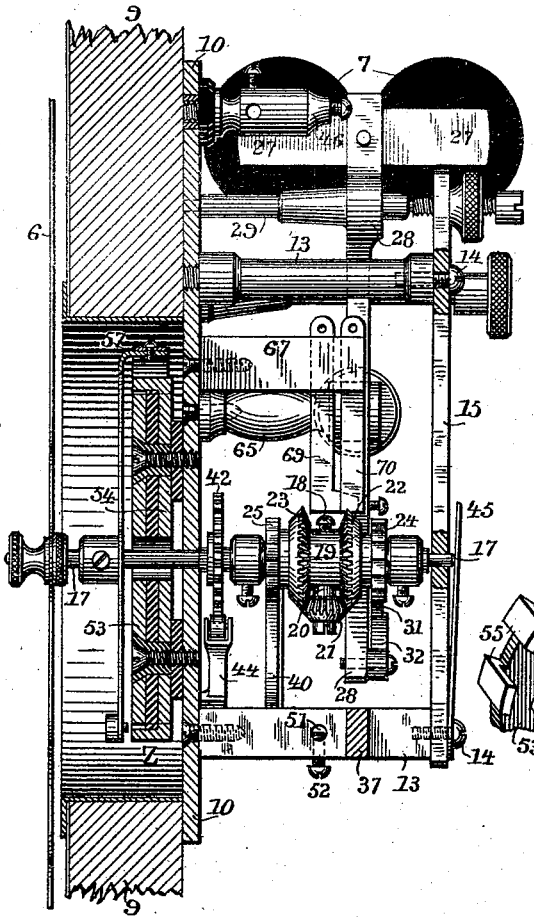


Fig. 16.

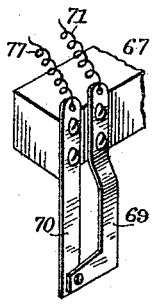


Fig. 15.

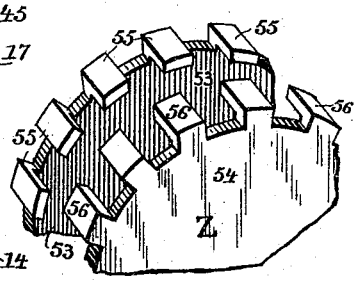
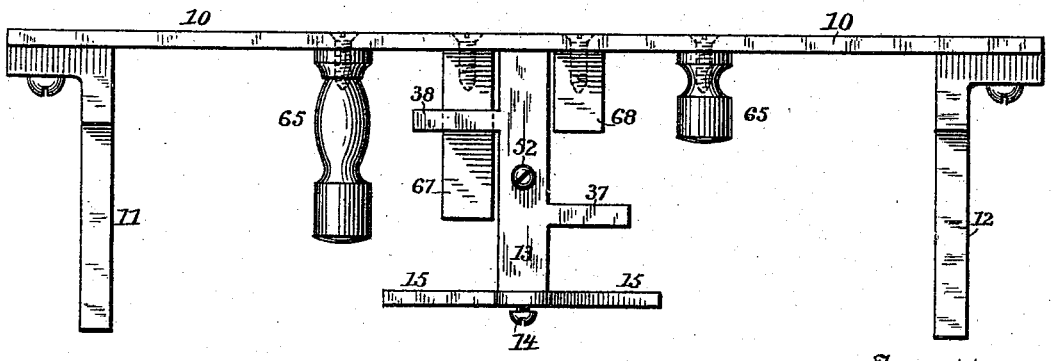


Fig. 12.



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(No Model.) 6 Sheets—Sheet 6.

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ELECTRICAL INDICATOR.

No. 492,011. Patented Feb. 21, 1893.

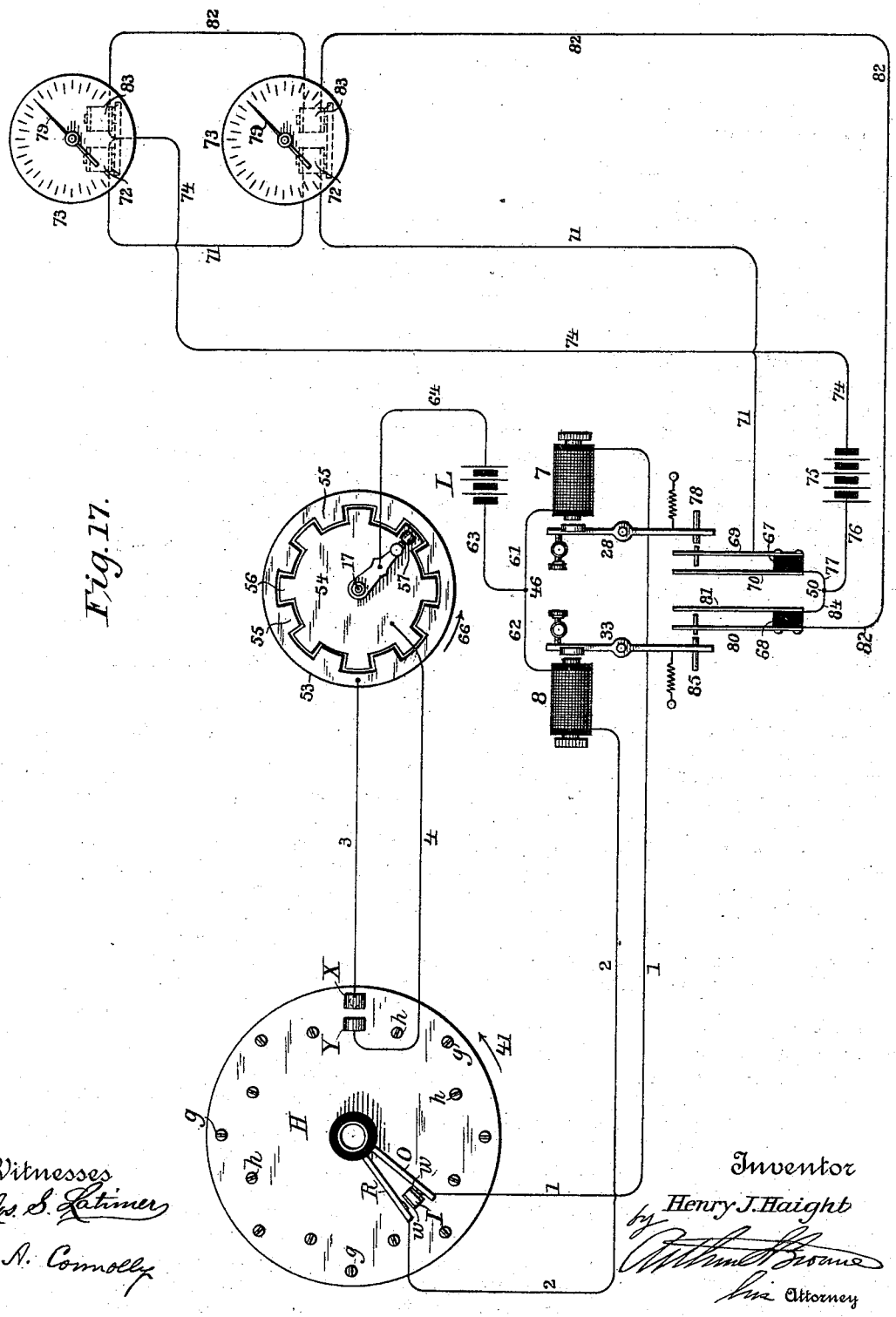

Fig. 17.

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UNITED STATES PATENT OFFICE.

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

ELECTRICAL INDICATOR.

SPECIFICATION forming part of Letters Patent No. 492,011, dated February 21, 1893.

Application filed June 1, 1892. Serial No. 435,182. (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 Electric Transmitters and Indicators Applicable to the Indication of the Direction of Wind and for other Purposes, of which the following is a specification.

In Letters-Patent of the United States No. 474,735, granted to me May 10, 1892, I have shown and described automatic electrical instruments for enabling the position of a wind-vane to be indicated at a distant place or places, so that the direction of the wind may be observed without looking directly at the wind-vane. The instrumentalities set forth in said patent consisted in an electric circuit-controller operated by the wind-vane, and an indicating instrument adapted to indicate the positions of the wind-vane.

Now the object of the present invention is to improve upon the instrumentalities set forth in said application, to enlarge the scope thereof, and to overcome defects therein. Whereas, however, the present improvements are primarily designed with reference to wind-vane indicators, they are applicable to other purposes, and can be used irrespective of the character of the information to be transmitted and indicated, or of the motive power which actuates the transmitter. The improvements will, however, for the sake of clearness, be described in detail only in connection with the indication of the positions of a wind vane.

The present improvements are illustrated in the accompanying drawings, wherein

Figure 1, is a perspective view of the wind vane mechanism. Fig. 2, is a central vertical section of the portion of the wind vane mechanism which carries the circuit controller. Fig. 3, is an elevation of the part of the wind vane mechanism constituting the circuit controller, detached. Fig. 4, is a horizontal section in a plane indicated by the line 4—4 in Fig. 3. Fig. 5, is a vertical section on a larger scale of a portion of the circuit controller mechanism shown in Fig. 2. Fig. 6, is a cross section on an enlarged scale, in a plane indicated by the line 6—6 in Fig. 5. Fig. 7, is a plan view of the stationary electrodes X, Y. Fig. 8, is a detail view on an enlarged scale of the electrodes X, Y, and a portion of the disk H. Fig. 9 (Sheet 1) is a front view of an electric indicating instrument used in connection with the wind vane mechanism. Fig. 10, is a rear view of the operative mechanism of the electric indicating instrument. Fig. 11, is a central vertical section thereof. Fig. 12, is a bottom view of the frame-work alone of the indicating instrument upon which the operating parts are mounted. Fig. 13, is a detail view of the actuating mechanism of the indicating instrument for moving the index in one direction only. Fig. 14, is a detached rear view of a "commutator" or cut-out employed. Fig. 15, is a perspective view of fragmentary portions of the commutator. Fig. 16, is a detail perspective view of a relay device employed. Fig. 17, is a diagram illustrating the circuit connections between the transmitter and receiver and the mode of operation.

Referring first to Figs. 1 to 8, the wind vane and the circuit-controller operated thereby will be described.

A, is a standard or other suitable support, which carries the wind vane mechanism and the circuit controller. To this standard or support A, is rigidly secured a vertical hollow metallic tube B. To this supporting tube is rigidly secured, by screws or otherwise, the lower half C of a hollow spherical shell, which has an open tubular sleeve *a* slipping over the tube B, whereby the hemisphere C, is secured to the tube B. The upper half or hemisphere D, of the hollow spherical shell is supported by and secured to the lower hemisphere C. The hollow spherical shell thus formed constitutes a tight inclosing casing for the circuit-controlling mechanism. The upper hemisphere D, has a central aperture and carries a vertically-extending pipe or elongated sleeve E, in line with and communicating with said aperture.

F, is the vertical metallic shaft or spindle which carries the wind vane G, rigidly connected therewith. This shaft or spindle extends through the elongated guiding sleeve E, which constitutes both a guide and a bearing therefor, and thence centrally through the hollow spherical shell C D. Its lower end enters the upper end of the vertical tube B, and seats upon a step-bearing *b* located with-

in said tube. The usual compass arms *c* are secured to the sleeve E.

Within the hollow spherical casing C D, the spindle or shaft F, carries a horizontal circuit-making-and-breaking disk H, of metal or electro-conductive material, which is rigidly secured to the said spindle or shaft F, so as to rotate therewith. The metallic disk H, while carried by the shaft F, is at the same time insulated therefrom. Immediately surrounding the shaft F, is a sleeve *d* of hard rubber or equivalent insulating material, and secured to this hard rubber sleeve is an encircling metallic sleeve *e*. The central hollow boss *f* of the disk H, is slipped over sleeve *e*, and is rigidly secured thereto by set screws. The metallic disk H, is thus electrically insulated from the shaft F, and from all parts in metallic connection therewith. Near its periphery, the disk H, is provided with two sets or series of electro-conductive contacts *g* and *h*. Each of these contacts is a downwardly-extending pin screwed into the underside of the disk H, so as to be in electric communication therewith and having its lower end beveled as shown in Fig. 3. The contacts *g* constituting the outer set are equidistant from each other and equidistant radially from the axis of the shaft F. The contacts *h* constituting the inner set are likewise equidistant from each other and equidistant radially from the axis of the shaft F. The contacts *g*, alternate with the contacts *h* circumferentially, as shown in Fig. 4, each contact *h* being circumferentially half-way between two of the contacts *g*. The circumferential distance between one contact *g*, and the next contact *h* constitutes a unit of distance on the disk, and consequently each pair of contacts of either set, *g* or *h*, is separated by two units of distance. The number of these units of distance (where the circuit-controlling disk H, is used with a wind vane), corresponds with the points of the compass, and may correspond with sub-divisions of the compass as minute as it may be desired to read. The illustrated disk H, has sixteen contacts *g* in the outer set, and sixteen contacts *h* in the inner set, corresponding with the thirty-two points of the compass. It will be noted that in Figs. 2, and 3, only a few of the contacts *g* and *h* have been illustrated, since to show all thirty-two would introduce confusion into the figures. In addition to this series of contacts *g h*, the disk H, carries a downwardly-extending vertical circuit-closing pin I, in metallic and electrical connection therewith.

The upper end of the supporting tube or pipe B, is surrounded by an immovable sleeve J, of hard rubber or equivalent insulating material, so that all parts carried by said sleeve J, are insulated from the supporting tube. (See Figs. 5, and 6.) Fastened to the insulating sleeve J, are three fixed, separated (and consequently insulated) metallic collars *i*, *j* and *k*, and a metallic sleeve *l*. The three collars *i j k* carry respectively fixed metallic brackets *m*, *n* and *o*. To brackets *n* and *o* are secured electric wires or conductors 1, and 2, respectively, which both lead to one pole of an electric generator L. (See Fig. 17.)

The fixed metallic bracket *m* (on collar *i*) carries fixed thereto a plate M, of insulating material such as hard rubber. To this insulating plate M, are fastened two electrodes X, Y, which are thereby insulated from each other and from the other parts of the instrument. Each of these electrodes X, and Y, consists of a metallic bowl *p* journaled in a metallic bearing *q* carried on the end of a metallic spring *r* secured to the plate M. The resilience of the spring *r* tends to move the bowl *p* outwardly away from the plate M, but the outward movement of the bowl is limited and determined by a stop nut *s* co-operating with a screw *t* carried by the plate M, and passing through a slot *u* in the spring *r*. The electrodes X, and Y, are connected respectively by electric wires or conductrs 3, and 4, with the opposite pole of the generator L to that with which the conductors 1 and 2 connect. (See Fig. 17.) The two electrodes X and Y, are arranged with their contact bowls *p p* side by side and in line radially with the axis of the disk H. The outer electrode X, co-operates with the outer set of contacts *g*, and the inner electrode Y, co-operates with the inner set of contacts *h*. Each bowl *p* is in the path of its corresponding contacts *g* or *h* on the disk H, so that as disk H rotates the bowls are brought successively in contact with the contacts *g h*. When not in contact with one of its contacts, the circuit through the bowl is broken, since the stop *s* prevents the bowl coming in contact with the disk H, or the bearing *q* coming in contact with the contacts on the disk H. As the disk H, rotates, the electrodes X, and Y, thus come alternately in contact with their co-operating contacts *g* and *h*. When electrode X, is in contact with one of the contacts *g*, the latter is in electric communication through wire 3 with one pole of the generator L, and the electrode Y, is out of contact with any of its co-operating contacts *h*. And when electrode Y, is in contact with one of the contacts *h*, the latter is in electric communication through wire 4, with one pole of the generator, and the electrode X, is out of contact with any of its co-operating contacts *g*. Since the electrodes X, Y, are stationary, while the disk H, rotates with the shaft F, it follows that whenever the direction of the wind shifts the circuit through the generator will be made and broken one or more times depending on the extent of the change in direction.

Encircling the sleeve *l*, at the upper end of the tube B, is a rotary metallic sleeve N, the sleeve *l* constituting a guide and bearing for said sleeve N. This sleeve N, is provided with a horizontally and radially extending metallic arm O, which constitutes an electrode and extends into the path of the pin I, on the disk H.

Surrounding the sleeve N, is a sleeve P, of insulating material such as hard rubber, and surrounding this insulating sleeve P, is a metallic sleeve Q. Sleeves P, and Q, are both rigidly connected to the sleeve N, so that the three sleeves N. P. Q. rotate together around sleeve *l*, sleeve Q, being, however, insulated from sleeve N, by the intermediate sleeve P. The sleeve Q, carries a horizontally and radially extending arm R, constituting an electrode, which extends into the path of the stud or pin I, on the disk H. The electrodes or arms O, R, are held separated from each other at an invariable distance that is slightly greater than the diameter of the pin or stud I, which is located between them. The arms O, R, and pin or stud I, are provided with co-operating contact pieces *w* of platinum (see Figs. 3, 4, 6).

The fixed bracket *o* on fixed collar *k*, has two spring contacts, electrodes, or brushes S, S, which, by the resilience of the metal of which they are composed, press in electrical contact upon the outer surface of the sleeve Q. Consequently electrode R, is always in metallic connection with branch return conductor 2.

The inner rotary metallic sleeve N, is of greater width than sleeves P, Q, so that a portion of its outer surface is exposed. Against this exposed surface of sleeve N, two spring contacts, electrodes, or brushes T, T, (carried by fixed bracket *n*, on fixed collar *j*) press in frictional contact by reason of the resilience of the spring metal of which they are composed, so that the electrode O, is always in metallic electric connection with the branch return conductor 1. It consequently follows that, since the pin or stud I, is less in diameter than the distance between the electrodes O, R, only one of the branch return conductors 1, or 2, can be in co-operative relation with the main conductors 3, and 4. The particular one of the branch conductors 1, or 2, in operation is determined by the direction in which disk H, turns. As long as it turns in one direction (say in the direction of arrow 41), stud or pin I, will be in contact with electrode O, and consequently branch conductor 1, will be operative and will be brought alternately into communication with conductors 3, and 4. But if the direction of motion of disk H, is reversed, stud or pin I, will leave electrode O, and be brought in contact with the other electrode R, and consequently branch conductor 2, will be operative and will be brought alternately into communication with conductors 3, and 4.

The extent of play which the pin or stud I, has between the electrodes O, R, is less than the circumferential distance between two adjacent contacts *g* or *h*, so that the pin or stud I, will always be in contact with either O or R when the electrodes X and Y alternately open or close the circuit by co-operation with said contacts *g* or *h*.

The conducting wires 1, 2, 3, and 4, are led from their respective brackets *m*, *n* and *o*, into the interior of the supporting pipe or tube B, through an aperture *x* which establishes communication between the interior of the hollow spherical shell C D, and the interior of the tube B, below the step-bearing *b*. The wires are thus led out from the hollow shell C D, without necessitating an exposing opening therein. The wires 1, 2, 3, and 4, pass out from tube B, through the standard A, and are thence led in any desired direction.

The insulation of the disk H, from the shaft F, and of the collars *i*, *j*, *k*, and sleeve *l*, from tube B, protect all the parts of the circuit-controller and of the instruments connected with the conductors 1, 2, 3, 4, from the effects of lightning striking the wind vane.

In the main, the wind vane circuit controller shown in Figs. 1, to 8, inclusive, and as thus described, is the same as the corresponding instrumentalities set forth in my patent No. 474,735 above named. The principal feature of improvement which has been introduced by the present invention is the employment of the two electrodes X and Y, having independent connections with the electric generator, and the two sets of electrodes *g* and *h*, carried by the disk H, together with the features of construction connected therewith. The purpose of this change will be hereinafter fully set forth in connection with the description of the diagram Fig. 17. In other respects the construction of the wind vane and its circuit controller set forth in said patent No. 474,735, have been in the main followed.

The indicating instrument which is illustrated in Figs. 9, to 16, inclusive, is one of that class of electric indicating instruments which comprise a fixed dial or reading scale 5 (see Fig. 9), an index 6, co-operating therewith and capable of a step-by-step movement in either direction, two electro-receptive devices, such as electro-magnets 7, 8, (see Fig. 10,) and mechanism intermediate between said electro-receptive devices, and said index, which moves said index in opposite directions depending upon which of said electro-receptive devices is actuated by an electric current.

The scale 5, index 6, and magnets 7, 8, of the indicating instrument, are all supported on a suitable supporting plate 9, of wood or other suitable insulating material, and to the rear of this plate 9, is rigidly secured a metallic plate 10. On opposite sides of this plate 10, are rigidly mounted two metallic brackets 11, 12, which support the magnets 7, 8, respectively. Also rigidly mounted on the plate 10, are two perpendicular metallic posts 13 to which is rigidly secured by screws 14, a T-shaped metallic bridge 15, which is thus held parallel with the plate 10, and in rigid and immovable connection therewith. On this rigidly mounted and secured bridge 15, and the plate 10, are mounted all the actuating mechanism between the magnets 7, 8, and the index 6. The index 6, is secured to a spindle or shaft 17, which is journaled in bear-

ings formed by the plate 10, and the bridge 15. Rigidly secured to this shaft or spindle 17, by means of a set screw 18, between the plate 10, and the bridge 15, is a collar 19, having a radially-extending stud 20, on which turns a bevel pinion 21. This bevel pinion gears at all times at diametrically opposite points with two parallel bevel gears 22, and 23, which rotate loosely on the shaft or spindle 17. Rigidly connected to the bevel gear 22, so as to rotate therewith, is an advancing ratchet wheel 24; and rigidly connected to the bevel gear 23, so as to rotate therewith is a reversing ratchet wheel 25. The gears 21, 22, and 23, constitute a species of epicyclic train.

In order to rotate the advancing ratchet 24, the magnet 7, is provided. The armature 27 of this magnet is carried by a vibrating armature lever 28, which is carried by a rock shaft 29, journaled at opposite ends by suitable provisions in the bridge 15, and metal plate 10. This armature lever is vibrated in one direction when the armature 27, is attracted to the magnet 7, on the excitation of the same by the passage of an electric current, and in the opposite direction by a spring 30. The long arm of this armature lever 28, carries a pawl 31 pivotally mounted thereon which engages with the advancing ratchet wheel 24. This pawl is held in engagement with the ratchet wheel by a spring 32. In an exactly similar manner the magnet 8, controls the movement of armature lever 33, carrying its armature 34. Lever 33, has a pawl 35, which normally engages with the reversing ratchet 25, being held in engagement therewith by a spring 32. Since the pawls 31, and 35, of the two armature levers are on opposite sides of the spindle or shaft 17, it follows that the advancing and reversing ratchets 24, and 25, will be rotated in opposite directions by their respective pawls, and since the pawls are always in engagement with the ratchets it follows that the ratchets 24, and 25, cannot move backward. The rigid connection of the ratchets 24, and 25, with the turning bevel gears 22, 23, respectively, and the presence of the intermediate epicyclic bevel pinion 21, enable the shaft or spindle 17, to be rotated in opposite directions. When the advancing ratchet 24, is rotated, by the action of armature lever 28, the loose gear 22, turns with it and carries the epicyclic bevel pinion 21, round with it. The reversing ratchet 25, and its gear 23, cannot turn with the ratchet 24, owing to the pawl 35. Consequently, as the bevel pinion 21, is carried around, it rotates on its own axis by reason of its engagement with stationary bevel gear 23. The shaft or spindle is thus caused to rotate forward in the same direction that the advancing ratchet 24, turns. When, however, the reversing ratchet 25, is rotated by the action of its armature lever 33, an exactly equivalent effect is produced, except that the shaft or spindle rotates backward or in the opposite direction, the advancing ratchet 24, in this instance being prevented from backward rotation by the pawl 31.

The arc through which the shaft or spindle 17, moves at each movement of either armature lever depends upon the extent of movement of the armature levers, the number of teeth on each of the ratchets 24, 25, and the relative size of the epicyclic pinion 21, as compared with the gears 22, 23. The extent of movement of the armature levers is regulated by set screws 36, carried by fixed pillars 65. In the illustrated instrument, the ratchets 24, 25, have each sixteen teeth, the movement of each armature lever is sufficient to move its ratchet one tooth at a time, and each bevel gear 22, 23, is twice the diameter of, and has twice as many teeth as, the epicyclic pinion 21. Consequently, the shaft or spindle 17, and the index 6, move through an arc equal to one thirty-second part of a complete rotation at each step. This length of step is a proper one in the illustrated indicator, since it corresponds with the number of contacts *g h* of the wind vane circuit controller.

It is obvious that the extent of each step of the shaft 17, and its index 6, can be regulated to any extent by the introduction of gearing between the ratchets 24, 25, and the gears 22, 23, respectively. It is only essential that the ratchets 24, 25, should be so connected with the respective gears 22, 23, as to rotate simultaneously therewith.

The indicating instrument as thus far described is identical in operation, and substantially identical in construction, with the corresponding instrument set forth in my above-named patent No, 474,735, dated May 10, 1892. The improvements upon the same will now be described.

The lower post 13, has two laterally and oppositely projecting arms 37, 38, (see Fig. 12,) to each of which are pivoted upwardly-extending detents 39, 40, which are held by springs 41 also carried by the arms 37, 38, in contact with the ratchets 24, and 25, respectively. These detents prevent the ratchets being rotated backwardly by the backward drag of their respective operating pawls 31, and 35. I am well aware that it is old to add detents to ratchets to prevent the backward rotation thereof. Heretofore, however, in electric indicating instruments, where the index-carrying shaft has to be rotated in opposite directions, it has been necessary to either omit detents or to provide means for throwing such detents out of action since they permit rotation in one direction only. The use of the epicyclic gears 21, 22, 23, enables the detents to be used, since each of the gears 22, and 23, moves in one direction only. Close to the plate 10, the shaft 17, carries a star wheel 42, having as many notches as there are steps in a complete rotation of the shaft 17, and with this star wheel engages a bowl 43 carried by a spring 44, whereby the bowl is held in frictional contact with the star wheel 42. This device insures the accurate

movement of the shaft one step at a time. Bearing against the outer end of the shaft 17, where it projects through the bridge 15, is a spring 45, which bears frictionally on the shaft and assists in maintaining the shaft in the positions to which it may be moved.

The plate 10, carries a suitable number of binding posts 46, 47, 48, 49, 50, for the connection of the several wires. These binding posts are insulated from the plate 10. The lower post 13, has a wire opening 51, and binding screw 52, so that post 13 serves also as a binding post. Post 13 is in metallic contact with all the metal work of the indicating instrument (not specially insulated) including the shaft 17.

Forward of the plate 10, concentric with the shaft 17, but insulated from both, is a stationary device Z, which I term a "commutator" by reason of its structural resemblance to the commutator of a dynamo-electric machine. This commutator consists of two metallic disks 53, 54, (see Figs. 11, and 15) which have intermeshing sections 55, 56, respectively. The two plates 53, 54, with their respective sections 55, 56, are wholly insulated from each other. The sections 55, 56, are arranged in a circle concentric with the shaft 17, with their outer surfaces parallel with the shaft. The sections 55, 56, alternate with each other, and are equal in number with the contacts *g h*, that is, in the illustrated construction they are thirty-two in number. The disks 53, 54, are connected by wires 3, 4, respectively, with binding posts 48, 48.

Co-operating with the commutator Z, is a revolving metallic brush 57, which is carried by the shaft 17 so as to rotate therewith, and which travels in contact with the sections 55, 56. During the step-by-step rotation of the shaft the brush is brought successively into contact with the several sections 55, 56, so that the brush 57 (which is in metallic contact with binding post 13) is brought alternately into metallic connection with the disks 53, 54.

The purpose of the commutator Z, and the connections between the circuit controller and the indicator, will be described in connection with the diagram Fig. 17. In this figure the several instrumentalities are somewhat conventionalized but will be readily recognized. Conductor 1, extends from electrode O, co-operating with stud I, on disk H, to advancing magnet 7. Conductor 2, extends from electrode R, co-operating with stud I, on disk H, to reversing magnet 8. Magnet 7, is connected by conductor 61, and magnet 8, by conductor 62, with binding post 46, from which conductor 63, leads to one pole of the electric generator L. From the opposite pole of generator L, conductor 64, leads to the brush 57. The conductor 64, is the one which is connected with binding post 13, from which there is metallic connection with brush 57, through bridge 15, and shaft 17. Conductor 3, extends from electrode X, co-operating with the outer series of contacts *g* on rotating disk H, to the disk 53 of the commutator Z. Conductor 4, extends from electrode Y, co-operating with the inner series of contacts *h* on disk H, to the disk 54 of the commutator Z.

In the position of parts shown in the diagram, Fig. 17, stud I is in contact with electrode O, electrode X, is in contact with one of the contacts *g*, electrode Y, is idle, and brush 57, is in contact with one of the sections 56, of the commutator disk 54. Hence all of the circuits are open. Assume now that the disk H, is rotated in the direction of arrow 41, O will still remain in contact with I, and contact *h* below Y, is brought into contact with Y. A closed circuit is then established as follows:—from generator L, through conductor 64, brush 57, disk 54, conductor 4, electrode Y, contact *h*, disk H, stud I, electrode O, conductor 1, magnet 7, and conductors 61, 63, back to the generator L. The closing of the circuit excites magnet 7, thus moving shaft 17, one step, and consequently moving brush 57 one step (say in the direction of arrow 66) thus transferring brush 57 from contact with a section 56 of disk 54, into contact with a section 55 of disk 53. This movement of brush 57, at once breaks the circuit again, since brush 57, is then brought into electric connection with electrode X, (which is then dead, since, when Y is in contact with a contact *h*, electrode X is intermediate between two of the contacts *g*,) and the connection between live electrode Y, and the generator is broken at the disk 54. Should, however, the disk H, rotate in the direction opposite to arrow 41, the stud I will leave electrode O, and come in contact with electrode R. Further rotation of disk H, will bring the contact *h* next above electrode Y into contact therewith. The circuit will then be closed through wire 2, reversing magnet 8, wire 62, wire 63, generator L, wire 64, brush 57, commutator disk 54, wire 4, electrode Y, contact *h*, disk H, stud L, electrode R, to wire 2, again. Reversing magnet 8, will then be excited, rotating shaft 17, one step in the direction opposite to arrow 66, thus bringing brush 57, into contact with a section of disk 53, breaking the circuit, and rendering electrode Y dead, and electrode X live. The function of electrodes O, R, and stud I, is thus to determine whether advancing magnet 7, or reversing magnet 8, shall be in circuit, this function being old, as shown in my aforesaid patent No. 474,735. And the function of brush 57, and commutator disks 53, and 54, is to determine which of the two sets of contacts *g*, or *h*, shall be "live" or "dead."

It will be noted that when the series of contacts *g*, are dead they remain so until one of the contacts *h* comes in contact with electrode Y. Then immediately contacts *g* become live and contacts *h* become dead and remain so until one of the contacts *g* encounters electrode X. Two contacts of either set of contacts, as *g g*, cannot therefore operate until

the contact *h*, intermediate between them has operated, nor can one contact *g*, having operated, operate again until one of the adjacent contacts *h h* has operated. The object of thus having two rows of contacts *g h*, two commutator disks 53, 54, with alternating sections, and the electrodes X Y and brush 57, will be best appreciated by considering the defects which experience has developed in the apparatus shown in my said patent No. 474,735. If, on the diagram Fig. 17 of the present case, only the electrode X, and its contacts *g* were employed and wire 64 should lead directly from generator L, to electrode X, the arrangement of said patent would in substance be reproduced. In such a construction, electrode X would always be in communication with the generator, and any make and break in the circuit through it would excite either magnet 7, or magnet 8. The making and breaking of the circuit may occur accidentally and in absence of rotation of the disk H. Assume, for example, that the disk H, should be jarred or rocked, so as to separate electrode X, and contact *g*, and then bring them together again. This action would close the circuit, and consequently move the index of the receiving instrument without any corresponding movement of the transmitter. Again, the space between the electrodes O, R, must be greater than the diameter of the stud I, and slight jarring of the disk H, will cause stud I, to make and break contact with one electrode, as O, without coming in contact with electrode R. If this occurs when there is contact between electrode X, and contact *h*, the index of the receiving instrument will be moved without any corresponding movement of the transmitter. These accidental makes and breaks are particularly liable to occur where the transmitter is used with a wind vane. It is of course essential to the operativeness of any indicating system that there should be always an exact accordance between the transmitter and receiver. Now the present improvements entirely eliminate the possibility of any accidental makes and breaks which would affect the receiving instruments. As soon as a contact *g* or *h* on disk H, touches a "live" electrode X or Y, the index of the receiving instrument is moved, and instantly the commutator brush is shifted so as to cut out the generator. No extent of vibration of the disk H, can then be of any consequence, since the disk H, must rotate one unit of distance before a circuit through the generator can be closed.

The indicating instrument illustrated in Figs. 9, to 16, not only acts as an indicating instrument but also as the means for cutting out the transmitter except at the instant when the transmitter completes a movement through one unit of distance. It is also constructed to act as a relay instrument for re transmitting the indications received by it to one or more other places.

Secured to the plate 10, and extending backwardly therefrom, are two posts 67, 68, of insulating material (see Fig. 12.) The post 67, is located just within the advancing armature lever 28. This post carries two separate spring electrodes 69, and 70, insulated from each other by the post 67. These electrodes are best shown in Figs. 13, and 16. These electrodes 69, and 70, constitute the terminals of an electric circuit. Electrode 69, is connected by wire 71, with binding post 49 (see Fig. 10,) and thence by wire 71 (see the diagram Fig. 17) with the advancing magnets 72, 72, of a plurality of electric indicating instruments 73, arranged in series. These electric indicating instruments 73 may be of any approved construction, as for example of the construction set forth in my said patent No. 474,735. A return wire 74, leads from the last magnet 72, in the series to one pole of an electric generator 75. From the opposite pole of generator 75, a wire 76 leads to binding post 50, and from thence a wire 77, leads to the other electrode 70. This circuit is normally an open one. When, however, advancing armature lever 28, is moved by the excitation of its actuating magnet 7, a stud 78, of hard rubber or other insulating material carried by the lever encounters the electrode 69, thereby bringing the latter into contact with electrode 70, closing the circuit actuating the several magnets 72, and advancing the respective indexes 79, of the several indicators 73, one step. The other post 68, is located just within the reversing lever 33 (see Fig. 10.) Post 68, carries two separated spring electrodes 80, and 81, insulated from each other and constituting the terminals of an electric circuit. Electrode 80, is connected by wire 82, with binding post 49 (see Fig. 10) and thence by wire 82 (see the diagram Fig. 17) with the reversing magnets 83, 83, of the indicators 73, arranged in series. The last magnet 83, of the series is connected by return wire 74, with one pole of the generator 75. From the opposite pole of the generator 75, wire 76 leads to the binding post 50, and from thence a wire 84, leads to the other electrode 81. This circuit is normally an open one. When, however, reversing armature lever 33, is moved by the excitation of its actuating magnet 8, a stud 85, of insulating material carried by the lever encounters electrode 80, thereby bringing the latter into contact with electrode 81, closing the circuit actuating the several magnets 83, and reversing the respective indexes 79, of the several indicators 72, one step.

It is evident that numerous modifications may be made in the construction of the instruments without departing from the spirit of the invention.

The central feature of the invention is the cut out device or commutator which cuts out the electrodes of the transmitter as soon as they have fulfilled their transmitting function. The cut out or commutator need not be used in connection with an indicating in-

strument, but may be used in connection with instrumentalities for operating it alone.

In the transmitting instrument the projecting studs *g h* constituting contacts on the disk H, might be replaced by electro-conductive and non-conductive sections, as in my patent No. 474,735, but the latter sections are less desirable since moisture collecting on the disk H, is apt to spread across the flat sections and establish short circuits. The transmitting disk H, may be stationary and the electrodes X Y may be movable. In cases where the disk is rotated in one direction only, the stud I, and electrodes O, R, may be omitted, the disk H, in such case being connected directly with the generator. In such instance also, one of the magnets 7, or 8, would be omitted.

The transmitter H, need not be a flat disk. It might for example be a cylinder with two rows of contacts *g h* arranged in different planes and projecting either outwardly or inwardly. There may be more than two series of contacts *g h*, in which case there would be more than two electrodes X Y, and more than two commutator disks 53, 54. The double arrangement shown, however, is all that is necessary, and any other multiple arrangement would be merely a development of the principles of the invention. Since any such multiple arrangement would include and involve the use of the double arrangement, my subjoined claims, claiming the double arrangement, are to be understood as covering any multiple arrangement.

The commutator X, on the receiver can be located at any convenient place, and may itself be given the step-by-step movement, the brush 37 in such case being stationary.

I claim as my invention—

1. An electric transmitting instrument having two series of contacts, all electrically connected with one pole of an electric generator, the contacts of one series alternating with those of the other series, the electric generator, and two electrodes co-operating respectively with said two series of contacts, said electrodes and contacts being movable relatively to each other whereby said electrodes are brought alternately into electric connection with said pole of the electric generator, in combination with a cut-out device or "commutator" having two sets or series of alternating electro-conductive sections, said sets or series being insulated from each other, the several sections of one set or series being in electric connection with one of said electrodes, and the sections of the other set or series being in electric connection with the other electrode, a brush in electric communication with the opposite pole of the electric generator and co-operating with said alternating electro-conductive sections, said cut-out or "commutator" and brush having a movement relatively to each other, and mechanism controlled by the electric transmitting mechanism for moving said cut-out or "commutator" and brush relatively to each other, substantially as set forth.

2. The combination of an electric transmitting instrument, an electric receiving instrument controlled in its movements by said transmitter, and an automatic cut-out controlled in its movements by said receiver, said transmitter having two sets of alternating contacts all of which are in electrical communication with the electro-receptive provision of said receiver, said automatic cut-out having two sets of alternating electro-conductive sections each of which is in an independent circuit including one of the two sets of contacts of said transmitter, said automatic cut-out including a brush or equivalent contacting device co-operating with said electro-conductive sections one by one and in circuit with the electro-receptive provision of said receiver, and said transmitter including two independent and insulated electrodes each co-operating respectively with the contacts of one of said sets of contacts one by one, each of said electrodes being in circuit constantly with one of said sets of electro-conductive sections of the automatic cut-out, substantially as set forth.

3. The generator L, the contacts *g* and *h* in electric connection therewith, and the electrodes X and Y, in combination with sections 55, and 56, in electric connection with said electrodes X and Y, and brush 57, in electric connection with said generator L, substantially as set forth.

4. The transmitting disk H, capable of rotation in opposite directions, and having stud I, and two sets of alternating contacts *g*, and *h*, electric generator L, electrodes O, and R, on opposite sides of stud I, and electrodes X, and Y, co-operating with said contacts *g* and *h* respectively, in combination with shaft 17, magnets 7, and 8, intermediate mechanism between said magnet and said shaft for rotating said shaft in opposite directions, an electric generator L, electric conductors connecting both of said magnets with one pole thereof, conductor 1 between electrode O and magnet 7, conductor 2 between electrode R and magnet 8, the cut-out or commutator having two insulated series of alternating sections 55 and 56, conductor 3 between sections 55 and electrode X, conductor 4 between sections 56 and electrode Y, and brush 57 on shaft 17 and in electric connection with the opposite pole of said generator, substantially as set forth.

5. The transmitter H, having two sets of metallic pins *g* and *h* constituting electric contacts projecting therefrom, said pins being arranged in two rows, the pins in one row alternating in position with those in the other row, in combination with the two electrodes X and Y, co-operating respectively with said pins *g* and *h* said electrodes X Y being insulated from each other and included in independent circuits substantially as set forth.

6. In an electric indicating instrument, a driven rotary spindle or shaft, a pinion carried by and rotating with said spindle or shaft and having an independent rotation on its own axis, and two gears concentric with said spindle or shaft but free to rotate independently of said spindle or shaft, in combination with a ratchet wheel capable of movement on one direction only, said ratchet wheel being connected with one of said gears, a movable pawl co-operating with said ratchet wheel and constantly engaging therewith, a detent engaging said ratchet wheel to prevent backward rotation thereof, a second ratchet wheel capable of movement only in a direction opposite to that in which said first ratchet wheel moves, said second ratchet wheel being connected with the other of said gears, a second movable pawl co-operating with said second ratchet wheel and constantly engaging therewith, and a second detent engaging said second ratchet wheel to prevent any backward rotation thereof, substantially as set forth.

7. In an electric indicating instrument, the driven rotary index-carrying shaft or spindle, a collar fixed thereto so as to turn therewith, said collar having a radial stud, a bevel-pinion carried by and turning on said stud, and two bevel gears loosely turning on said shaft or spindle on opposite sides of said collar, said bevel-gears both meshing at all times with said bevel-pinion, in combination with two oppositely-toothed ratchet wheels secured fast to said bevel-gears respectively, the two swinging armature levers on opposite sides of said spindle or shaft having pawls which co-operate with said ratchets respectively, to drive the same, and which constantly engage with their respective ratchets, two detents engaging said ratchets respectively to prevent backward rotation thereof, and two electro-magnets which respectively control the movements of said armature levers, substantially as set forth.

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

HENRY J. HAIGHT.

Witnesses:
ALBERT A. BARNES,
JOSEPH A. STOCKEN.