No. 748,502. PATENTED DEC. 29, 1903.

F. B. HERZOG & S. S. WHEELER.

ELECTRIC SIGNALING APPARATUS.

APPLICATION FILED JAN. 25, 1886.

NO MODEL.

Fig. 1

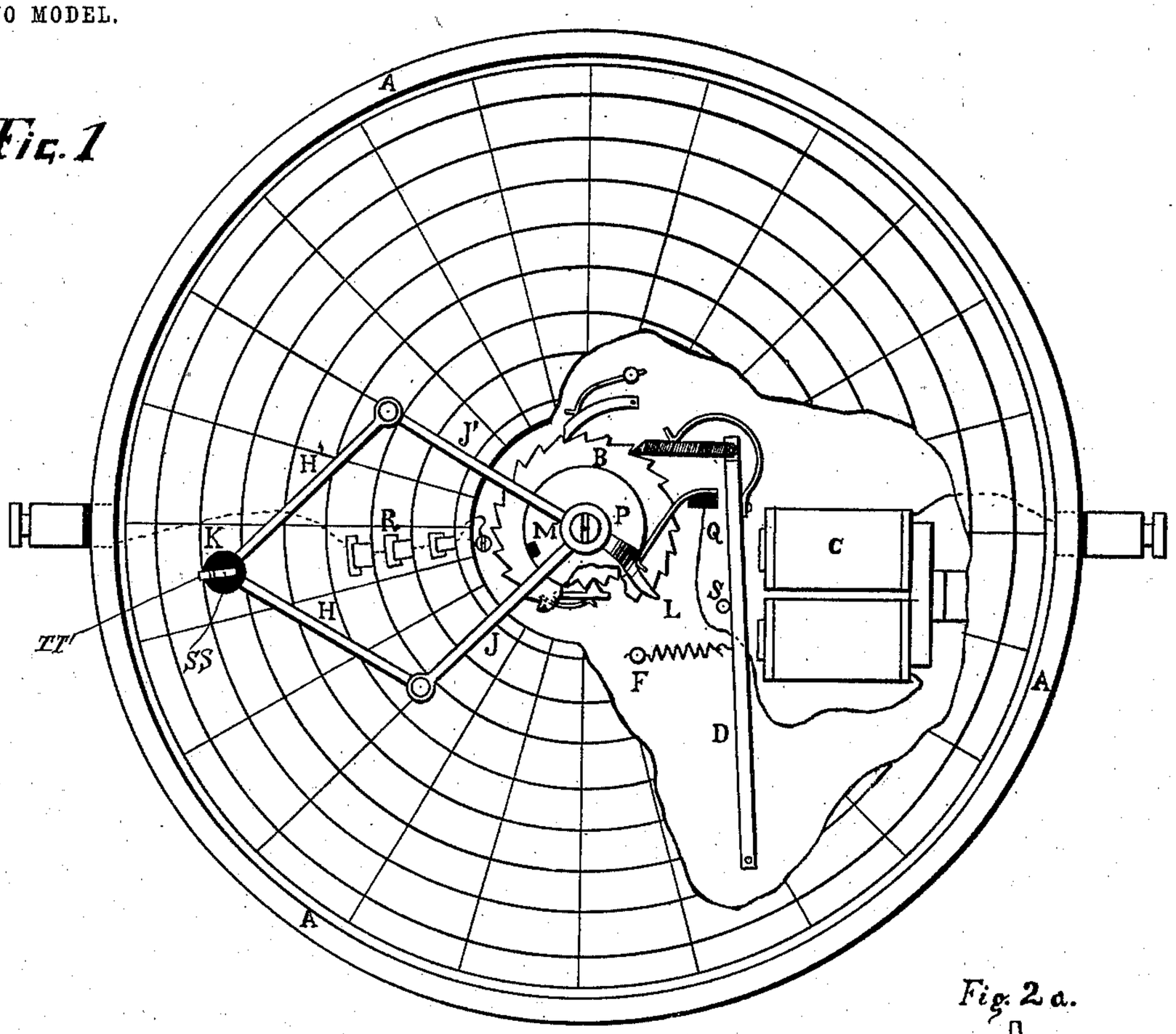

Fig. 2

Fig. 2a.

WITNESSES:

Edw. Raffin,

Chas. H. Laue

INVENTORS

F. Benedett Herzog & S. S. Wheeler

BY

F. Benedett Herzog

ATTORNEY.

No. 748,502. Patented December 29, 1903.

UNITED STATES PATENT OFFICE.

FELIX BENEDICT HERZOG AND SCHUYLER SKAATS WHEELER, OF NEW YORK, N. Y.; SAID WHEELER ASSIGNOR TO SAID HERZOG.

ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 748,502, dated December 29, 1903.

Application filed January 25, 1886. Serial No. 189 667. (No model.)

To all whom it may concern:

Be it known that we, FELIX BENEDICT HERZOG and SCHUYLER SKAATS WHEELER, citizens of the United States, and residents of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Electric Signaling Apparatus, of which the following is a specification.

This invention relates to an electric signaling or circuit-controlling apparatus of the general character shown in several pending and contemporaneously-filed applications in which two or more separately-variable signals or current variations are transmitted at one transmission and are varied according to the position in which one portion of the apparatus is set by the transmitting operator; and its main point of novelty is that it operates to produce or control from one station over a telegraphic circuit to a second station the manifestation thereat of two separately-variable signals or recognizable current variations which, considered jointly, correspond to or indicate (at such second station) the precise one of each of the various positions (in the apparatus at the first station) in which a transmitting operator has set one manually-movable element with respect to two or to more than two possible directions of motion or arbitrary starting-points located within the effective area, range, or fields within which said movable element is adapted to be carried about or placed. These fields or areas of motion in the organization herein selected for illustration as a typical embodiment of the invention are considered in part as being, or rather as coincident with, the dial-plate of a signal-transmitting apparatus and in part with a supplemental index which is operable with relation to the area or field.

Another point of novelty consists in the manner in which a part of the mechanism is controlled electrically, so as to move in two intersecting directions, and there are also other points of novelty.

We consider various features of this invention as broadly new, and therefore do not intend to limit ourselves to the precise form or use shown or suggested as species under the generic invention, although we also deem such species new as to many of the details shown.

In the drawings, Figure 1 represents generally a front view of the transmitter or apparatus at the sending-station, a portion of the face-plate being removed, so as to show the working parts, and it also shows generally the circuit leading to the receiving-station, as well as the apparatus thereat. Fig. 2 shows a section in elevation of the main apparatus of Fig. 1, some of the parts being in a different position and some of the parts being omitted. Fig. 2^A is an enlarged view of a detail of Figs. 1 and 2.

Referring to the figures, magnet C, armature D and its pawls, limiting-stop S, together with step-by-step wheel B, loosely mounted on arbor P, form a step-by-step movement of well-known character in conjunction with a ratchet-wheel, (shown only in Fig. 2 as being below the step-wheel B,) which is firmly fixed to the arbor and the teeth of which engage with a pawl (which, with its spring, is fixed to the lower face of the step-wheel B) and which is so shaped and adjusted with reference to the ratchet and step wheel that when the step-wheel is locked by its armature-pawl against manual rotation in a clockwise direction the arbor P may nevertheless be so rotated, because the ratchet may be moved, (its pawl idling over its teeth;) but the arbor may be manually rotated in a contra-clockwise direction, because then the step-wheel teeth will idle below the armature-pawl, (or the ratchet-wheel idle, because the tension of its spring is so adjusted;) but when the step-wheel is driven in a contra-clockwise direction by the armature the pawl fixed to the step-wheel will engage and carry along the ratchet and by way of this would also rotate the arbor or shaft P. Firmly fixed on or with relation to the main arbor P is the circuit-controlling disk M, and hence during the contra-clockwise direction produced by the magnetic operation the rotating arbor will carry with it the disk M, as well as another element also directly fixed to a conveniently-extended hub, which may be considered as a part of the main arbor. This additional element is the member J of the lazy-tongs or linkwork next to be described. This link-

work comprises the knob K, designed to be manipulated by the transmitting operator, and jointed to this are the opposing members H and H′, these having, respectively, pivoted to them the members J and J′. As J is rigidly fixed to the spindle, to which is also fixed the disk M, any given point thereof—for instance, the insulated spot M thereon—may be considered as fixed with relation to the said member J, and as the opposing member J′ is supported by the arbor in such manner that it can rotate around it and has a rearward extension (on which is shown insulated spot L) it follows that the points M and L will be brought together or separated in accordance with and in proportionate correspondence to the motion of knob K from or toward the central hub or shaft P. Thus for every possible position of the knob K in a given radius through the arbor P the distance between M and L will be different. As the knob is designed to be rotated as well as moved radially, a device is provided to keep the parts of the linkwork in any given position with relation to each other under the normal strain or tension used in manipulating it in a rotary direction, and this device consists of opposed and engaging crown-teeth in the upper face of the hub (an enlargement of the main arbor P) and in the lower face of a convenient extension or face of link element J′. These crown-teeth are normally held in engagement by the cylinder-spring A A, the lower end abutting against the upper face of the link J and the upper end thrusting against a convenient stop, (as the screw-head shown extending up from the hub P.) The size and number of these teeth will be determined by the number of positions in which it is desired that the knob shall stand. Cooperating with the knob (which has a downwardly-extending index or pin S S) is the face or operating area of the apparatus, which for the purpose of conveniently dividing the area into a number of identifiable spaces is shown as marked off as a dial, having columns arranged radially and divided into spaces by a series of circles concentrically drawn around the central arbor. Thus the knob may be moved by the operator circularly in either direction without disturbing the relation of the elements of the linkwork as to each other and in and out from the center, with the result that the relative positions of the links are changed, so as to produce corresponding changes in the relative positions of the points M on the disk and L on the extension of link element J′.

Bearing against the periphery of the disk M is a circuit-terminal consisting of a fixed contact-brush Q. This is of a width sufficient to engage the periphery of the disk M as well as the rearward extension L of the link element J′, which rearward extension for convenience of its coöperation with this brush is arranged on a plane beneath the dial-plate, as in Fig. 2.

It follows from what has been described that, taking the end of the fixed brush Q as a starting-point, the relative positions of this and of the spots M on the disk and L on the link J′ will vary for every possible position, radially or circular, of the knob K within its entire range of motion. Next to be described is how this variation in the relative positions of these three elements is translated to the receiving-station and what effect it may be made to produce thereat. For the purpose of showing how the specific form here illustrated as a typical embodiment of the broad invention may combine with transmitting mechanism of the general character shown in Herzog's patent, No. 292,115, with the other features hereof the apparatus at the receiving-station will be described only as used in said patent, it being understood that it may be widely varied therefrom according to the commercial requirement of each installation and use. Suitable circuit connections lead to the receiving-station. These are here shown as consisting of a simple circuit including in series at the transmitter the magnet C, brush Q, disk M, hub or arbor P, (and contacts R, hereinafter to be described,) and including at the receiving-station a battery or source of current T T and a high resistance, here conveniently shown as incorporated in the coil of the magnet of the telephone-receiver F. Arranged in shunt around this resistance is the contact-key G G. The normal strength of current is not sufficient to energize the magnet at the transmitter, but becomes sufficient for this purpose as soon as the receiver is shunted out by the depression of the key G G, and as soon as this key is again opened the retractile spring restores the armature D and carries with it the step-wheel B, and hence the knob K, which thus rotates a step or unit for each such actuation of the key at the receiving-station. This is the uniform effect at each actuation until in the course of the step-by-step rotation of the arbor P and its attached parts the insulated spot on disk M and the insulated spot on link extension L are carried past the brush Q. At these periods the current will be momentarily interrupted, but will be reëstablished at the conclusion of each of these steps, because the actuation of the step-wheel is not positively or directly by the magnet at its energization, but is produced negatively after deënergization and by the retractile spring of the armature. These spots are so small that they are passed over by the brush, which makes contact at that step both before and after the passage of the spot. At the receiving-station the operator listens at the telephone and counts the actuations of the key. The sound made in the telephone at each raising of the key will be uniform until the steps in the transmitter which carry these insulated spots into position to cause such total interruptions in the heretofore-uninterrupted circuit, and consequently

the operator can count the number of such depressions made before the arrival of the recognizable sound produced by the first total break and then again thereafter until the arrival of the second total break. From what has been described concerning the transmission it follows that inasmuch as the position of rest of the disk M against the brush Q will vary for every possible rotary position of the knob K, any step, and hence the one succeeding the first depression, may be considered as the initial point in the operation, and the number of actuations intervening between this and the occurrence of the first break in the circuit caused by the passage of the spot M under the brush and noted by the receiving operator on his telephone and identified as to sequence by the number of actuations of the key that he has counted up to that instant will enable him to deduce the position of the knob K at that initial step. In like manner the number of steps intervening between the first break in the circuit and the second (caused by the arrival of the insulated spot on L at the circuit-brush Q) will enable him to deduce the distance at the initial step of the knob K from the central hub, and these two distances consequently show him the exact position in intersecting directions in the area of the possible motions of the knob to which the knob has been moved. An arbitrary zero or initial point may be established at any convenient point on any dial that may be used with this apparatus.

The apparatus thus far described is complete; but it may be extended as follows: A part of the knob is designed for use as a supplemental index and is given a motion to and fro with respect to the dial or area in which its two other motions are made, and this third position is also indicated at the receiving-station, and the magnet at the apparatus also controls an inward motion of the knob and parts connected therewith. The rearward extension of the link element J′ is so shaped that after it reaches the brush Q it will be obstructed by it, and it is made of metal not insulated from the hub, and hence the circuit will remain completed at the transmitter. If the successive energizations of the magnet are now continued, the result will be that after each energization the armature will drive the wheel a step, as before, and hence link J, which is fixed with relation to the shaft, will also move a step; but its companion link J′ will be obstructed by engagement of its extension with the brush, and as the position-holding spring A A on the crown-tooth device is adjusted to give way under this exceptional strain it follows that the linkwork combination will carry the knob a fixed distance inward for every additional step of the wheel. Working in connection with the knob K is the plunger or pin S S, adapted to be raised to as many positions as may be required for any particular apparatus and to be held by engagement of one of the notches cut in its edge with the position-holding spring T T′. Fixed to the dial-plate in such position that this pin will pass between any of them when required for the circular motion of the knob and, considered radially, fixed at the proper distances apart are as many switches R as required. Each switch is so arranged that inward motion of the plunger-pin S S will strike one of the members which is longer than the other and carry it away from the other, thus opening the main circuit at the particular switch so operated, and these longer members are arranged so that each is longer or higher, according as it lies nearer the center. The adjustment between these and the relative heights to which the pin may be raised is such that for every such position of the pin one of these longer members will obstruct it, and as the pin is being carried toward the central hub by the continued rotation of the wheel B it follows that the main circuit will be opened (by this engagement) at the switch which corresponds to the position to which the knob-plunger has been set. Thus for the lowest position of the pin the outer switch would be engaged. For the next position the outer switch would be passed and the next engaged, &c. As a different number of steps of wheel B will be required to bring about the engagement of each such switch and as this engagement will result in a break which will be recognizable at the second station, it follows that the operator by counting the steps before such a break will also be able to recognize that the pin has been raised and to what height it has been raised, if there is more than one such height. Thus the position of a single movable part (the pin S S) with respect to three to-and-fro directions of motion controls current effects corresponding thereto at the receiving-station.

It is obvious that, if desired, the area within which the knob may be moved radially and circularly instead of being left blank or being spaced off in squares, as in the drawings, may be occupied in whole or part with suitable index-marks—as, for instance, with words—and in this event if the receiving operator has a key or code he will be able to recognize what word has been intended merely because he has been able to recognize at what location in intersecting directions within the field or area of motion the knob had been placed, and similar or other suitable code arrangements may, if desired, be made in connection with the up-and-down motion of the plunger or pin S S. Thus if, for example, the principles of the mechanism are embodied in a transmitter which employs them only to a limited degree—as, for example, such a transmitter fitted with a dial for the use of guests in a hotel-room—the dial used could be divided into spaces and the dial-spaces marked to indicate articles desired—as, for instance, "Sandwich," "Coffee," "Tea"—while the plunger S S would be in this instance limited in its function to indicate, for instance,

the number of such articles, as "Coffee for two," "Tea for three," or the use of this plunger as varying the transmission of the impulses may be neglected, and this portion of the invention may be operated entirely as a signal-receiver or controlled apparatus used, for instance, merely as an answer back from the signal-receiving operator to the signal-transmitting operator.

The operation of the signal-transmitter or circuit-controlling device has been explained only in connection with one special form of receiving apparatus shown; but it is obvious that there may be substituted in place of the one shown any form of receiver capable of being suitably affected by the variations in the position of the indicating-knob or, what is equivalent thereto, by the variations in the number of the units of distinct impulses of current which form the distinct groups which are produced by the manipulation of the operator, and it may be well to refer at this point to the state of the art as shown in some of the more closely related patents, as well as to the connection between this and other related inventions, applications for which are still pending.

Herzog's patent, No. 289,834, shows a transmitter capable of sending two groups of units or distinct impulses—*i. e.*, total interruptions of current caused by the alternation of conducting and non-conducting elements arranged to follow each other during an operation and coöperating with means at the controlled station adapted to be variably affected according to the varying numbers of such alternations. Herzog's patent, No. 292,115, modifies the interrupting device described by substituting a closure of variable length, and the effect produced at the controlled station is primarily to mark the beginning and the end of the group, other means being provided to control the variation in the number of intervening units. Our Patent No. 573,591 adds to the circuit-interrupting device of Herzog's patent, No. 289,834, a manipulator admitting of motion in intersecting directions, and our present invention is of this same general character and shows, as an illustration merely, a circuit-controlling element like that of Patent No. 292,115. Our Patent No. 573,592 shows a circuit-controller which comprises a self-acting rheotome and, furthermore, shows, as an illustrative form of receiver, an apparatus capable of visually coördinating a movable point in the suitable one of its many positions to correspond to the variation in the position of the transmitter, and hence in the number of units of current pulsations controlled thereby. In all of these forms of transmitters, however, provision is made to control the desired effect at the receiving-station by means of two series of impulses or pulsations composed of units of positive and distinct character, thus causing all of these forms to differ from the apparatus shown in Patent No. 217,588, Cowper, and Patent No. 420,833, Robertson, in which the variations in the position of a member manually movable in two intersecting directions neither produced nor controlled units of pulsations, which are substantially distinct and are grouped so as to vary in number, but act to vary the effective strength of current which is rendered apparent at the receiving-station. A comparison of all the forms referred to will show that the Herzog (and Herzog and Wheeler) devices all transmute motion of the manually-controlled pointer into distinct impulses or units which collectively compose a group, and the variations in extent of motion of the manipulator control variations in the number of units in the respective groups. A result of this principle of operation as compared with the principle of operation of the devices of Cowper and Robertson is that far greater variations may be made within practical limits, for the reason that many forms of apparatus are known in which effects may be positively and reliably indicated or controlled by a succession of impulses of substantially similar character operating cumulatively, whereas there is a narrower limit to the range of variations which may be made in the operation of any known receiving apparatus controlled as to such variations by variations in the strength of current produced by the indicated operations at the controlling-station, but even assuming that there is no such advantage as we believe to exist and as we have here set forth in the method of cumulative sequences as against gradual variations, it is to be understood that we do not endeavor to claim such sequences, except in connection with the specified constructions clearly set forth in our claims, and that it is clear that structural variations in the controlled apparatus may be requisite in the use of the one form which are not requisite in the use of the other form of current control, and it is our intention to limit ourselves (wherever such limitation is essential to mark the differences between the older and our newer form) to organizations in which such sequences substantially distinct and of equal strength are produced or controlled.

By the term "produced or controlled" we mean to point out that it is immaterial whether the impulses are produced directly at the transmitting-point, as in our Patent No. 573,591, or whether they are merely controlled in one of many possible ways—as, for instance, in the form of circuit-wheel chosen for illustration herein, in which the maximum length of the group as a whole is determined at the transmitter—but the individual unit or pulsation may more properly be said to be controlled or produced at another point. By the term "substantially distinct and of equal strength" we mean to indicate that we do not limit ourselves to the use of one strength or character of current—as, for instance, in the form of receiver chosen for illustration two strengths of current are used—as long as

there is employed in order to produce the particular effect for which the receiving organization is adapted a series of recurrent or cumulative impulses instead of an incremental or gradual variation of current.

From what has been described it will be seen that the invention is not limited to the specific devices shown either as to its features of controlling the transmissions to the receiving-station or as to the features by which the rotating knob and the device carrying it may also be controlled to move to and from the center—that is, in an intersecting direction—by the magnetic action.

We claim—

1. A circuit-controlling device comprising an operative member, manually movable in two intersecting directions in one plane and manually movable also in a reciprocal direction away from and toward that plane; substantially as described.

2. At one station, a circuit-controlling apparatus comprising a manually-movable member—as a knob; devices connecting this to other portions of the apparatus and coacting with these to permit an operator to move the knob back and forth in several intersecting directions; two or more elements constructed, adapted and arranged so that each is separately movable variably in accordance with the various motions of the knob; means cooperating with these elements in producing or controlling groups of pulsations, which groups include units substantially distinct from one another and adapted to affect suitable apparatus at a second station in electrical connection with the first station; together with means whereby the whole coöperates to vary the number of units of distinct pulsations included in each group in accordance with the variations of the movements of the knob; substantially as described.

3. At one station, a circuit-controlling apparatus comprising a manually-movable member—as a knob; devices connecting this to other portions of the apparatus and coacting with these to permit an operator to move the knob to a varying extent both back and forth in each of two intersecting directions; two elements constructed, adapted and arranged to be respectively movable to varying extent in correspondence with the extent of the motions of the knob; means coöperating with these elements for controlling the production of two groups of impulses in which the units composing the groups are of substantially equal strength of current to one another and affect suitable apparatus at a second station in accordance with the varying number of similar successive impulses in each group; together with means whereby the whole cooperates to determine the number of unit impulses in the respective groups in accordance with the extent of the movement of the knob along its respective paths of motion, substantially as described.

4. At one station, a transmitting apparatus comprising a manually-movable member—as a knob; devices connecting this to other portions of the apparatus, and coacting with these other portions to enable an operator to move the knob back and forth in intersecting directions in one plane; two elements, each constructed, adapted and arranged to be rotatable in either direction about a support and to be rotatable to a degree determined by the extent of motion of the knob in each of its paths; means whereby the direction of the rotation is determined by the respective directions of the motions of the knob; together with means whereby the whole coöperates to vary an effect produced upon suitable receiving apparatus at a second station in electrical connection with the first station, substantially as described.

5. In a circuit-controlling apparatus, a manually-movable member—such as a knob; devices connecting this to other portions of the apparatus and including two parts, each attached to the movable member at one point and each guided by suitable attachments at another point; these parts being constructed and adjusted so as to permit an operator to move the knob back and forth in intersecting directions in one plane; one or more rotatable elements constructed, adapted and arranged so that each is rotatable to a variable degree in accordance with the various motions of the knob, and devices acting to control this rotation by way of the two elements attached to the knob; and means cooperating with these rotatable elements to affect suitable apparatus at a second station in electrical connection with the first station, substantially as described.

6. At one station, a circuit-controlling apparatus comprising a manually-movable member—as a knob; devices connecting this to other portions of the apparatus and coacting with these to permit an operator to move the knob back and forth in intersecting directions in the plane of the coöperating surface; two elements constructed, adapted and arranged with relation to suitable support so that each is movable variably in accordance with the motion of the knob; means coöperating with these elements to vary the effect produced at a second station in electrical connection with the first, this variation being in accordance with the variable motions of the knob; devices for enabling the knob to be moved also toward and away from the plane within which it may be moved in intersecting directions; together with a third circuit-controlling element distinct from the two movable elements named, and constructed and adjusted so that its operation is dependent upon the position of the knob with reference to its last-named line of motion, substantially as described.

7. At one station, a circuit-controlling apparatus comprising two movable circuit-controlling elements; means whereby these cooperate with adjunctive devices to vary the

number of distinct impulses of current composing two groups separately distinguishable at another electrically-connected station; means whereby said variation in the number of impulses in each group is determined by the degree of motion given respectively to each of the said two elements; a manually-movable member—as a knob—arranged to be moved at will back and forth in two intersecting directions in a plane which is parallel to a surface which at least equals in area the field within which the knob is effectively movable; together with means whereby the degree of motion of each of the movable elements named is determined by the extent of the movement given the knob in each of its directions, substantially as described.

8. At one station, a circuit-controlling apparatus comprising two movable elements; means whereby these coöperate with adjunctive devices to produce two effects separately distinguishable at another electrically-connected station; means whereby said variations are determined by the degree of motion given to each of the said two elements; a manually-movable member—as a knob—arranged to be moved at will back and forth in two intersecting directions in a plane which is parallel to a surface which at least equals in area a field within which the knob is effectively movable, said field being divided arbitrarily as a dial bearing indications arranged in two substantially intersecting directions; means whereby the range of movement of each of the movable elements named is determined by the extent of the movement given the knob in each of its directions; together with means whereby the whole coöperates to produce at the receiving-station, variable effects respectively characteristic of the various indications of the dial, substantially as described.

9. At one station, a circuit-controlling apparatus comprising a manually-movable member—as a knob; devices connecting this to other portions of the apparatus and coöperating with these to permit an operator to move the knob back and forth in intersecting directions in one plane; two or more circuit-controlling elements constructed, adapted and arranged to coöperate with the other parts in varying the effect upon suitable apparatus at a second station; only one wire connecting the stations; and means acting to control the variable effect at the second station in accordance with the position of the knob with reference to both of its paths of motion, substantially as described.

10. A circuit-controlling apparatus comprising a movable element; means for moving this in two coördinating directions; devices and adjustments adapted to hold it at rest in the various positions in which it may be placed as the result of this coördinate motion; a number of fixed contacts each constructed and adapted to coöperate with the movable element and severally located at points corresponding to those to which said element may be brought by means of its double action; together with means including devices controlled electrically from a distant point and constructed and arranged to control, electromechanically, the motion of this movable element as to both of the said coördinating directions, substantially as described.

11. A circuit-controlling apparatus comprising a movable element; means for moving this in two coördinating directions; devices and adjustments adapted to hold it at rest in the various positions in which it may be placed as the result of this coördinate motion; a number of fixed contacts each constructed and adapted to coöperate with the movable element and severally located at points corresponding to those to which said element may be brought by means of its double motion; together with means including devices including a progressively-moving element—as a rotating arbor—and a magnet controlling its motion and controlled electrically from a distant point and constructed and arranged to control electromechanically the motion of this movable element as to both of the said coördinating directions, substantially as described.

12. A circuit-controlling apparatus comprising a movable element; means for moving this in coördinating directions; devices and adjustments adapted to hold it at rest in the various positions in which it may be placed as the result of this coördinate motion; a number of fixed contacts each constructed and adapted to coöperate with the movable element and severally located at points corresponding to those to which said element may be brought by means of its double motion; together with means including devices including a progressively-moving element—as a rotating arbor—and a magnet controlling its motion and controlled electrically from a distant point and constructed and arranged to control electromechanically the motion of this movable element as to both of the said coördinating directions; and means whereby the said movable element may be moved in a third coördinating direction, substantially as described.

Signed at New York, in the county of New York and State of New York, this 22d day of January, A. D. 1886.

F. BENEDICT HERZOG.
SCHUYLER SKAATS WHEELER.

Witnesses:
FRANCIS B. CROCKER,
PHILIP HERZOG.