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F. B. HERZOG & S. S. WHEELER.
ELECTRIC SIGNALING APPARATUS.

(Application filed Jan. 29, 1886.)

(No Model.)

2 Sheets—Sheet 1.

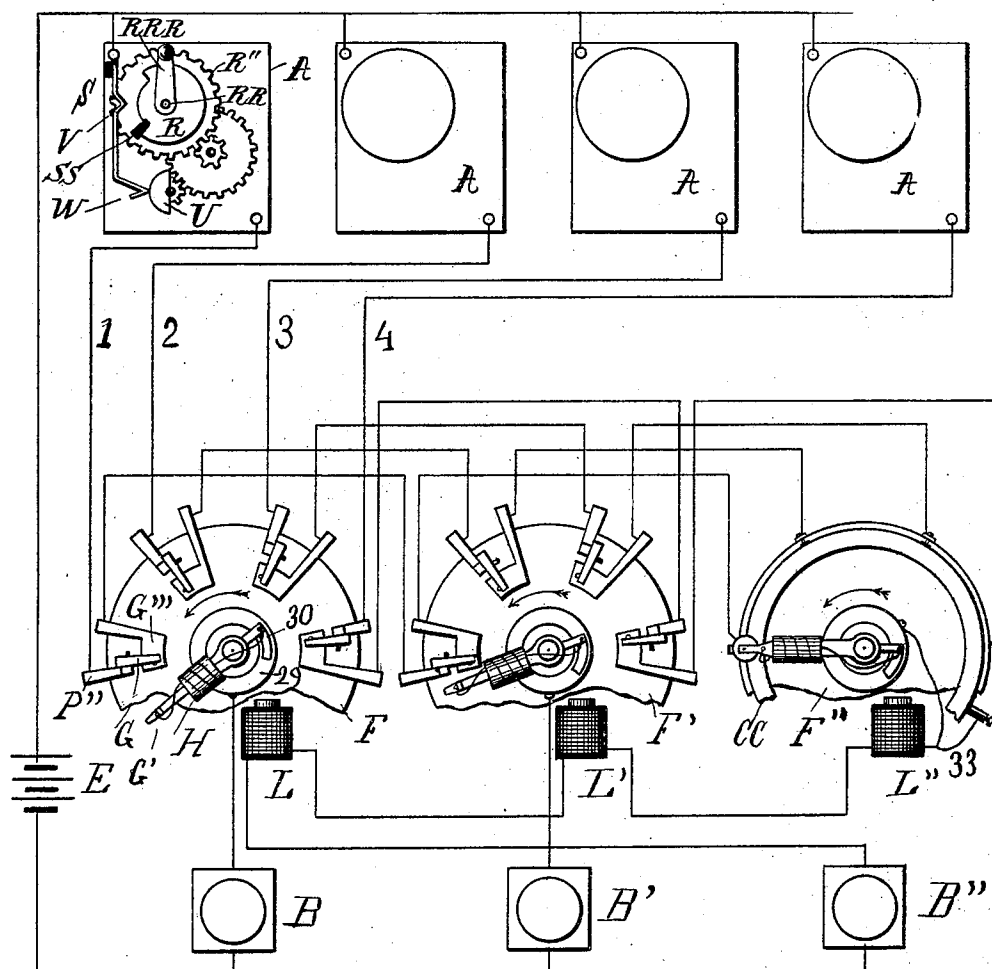


Fig. 1.

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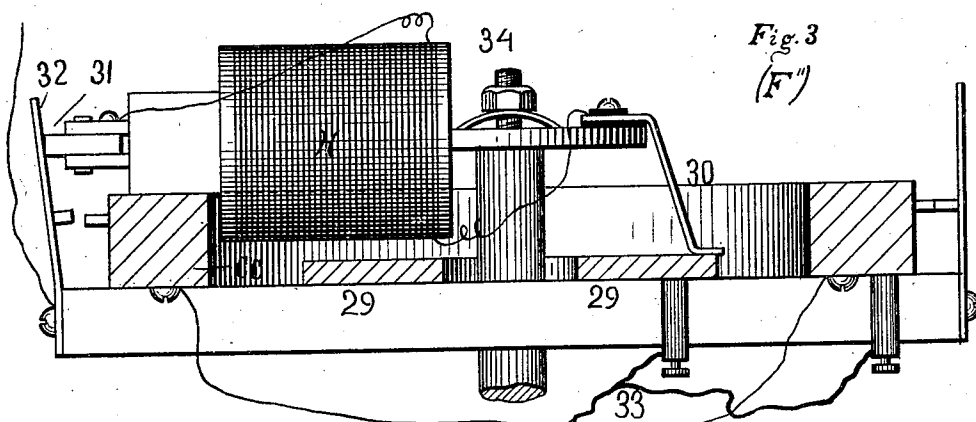
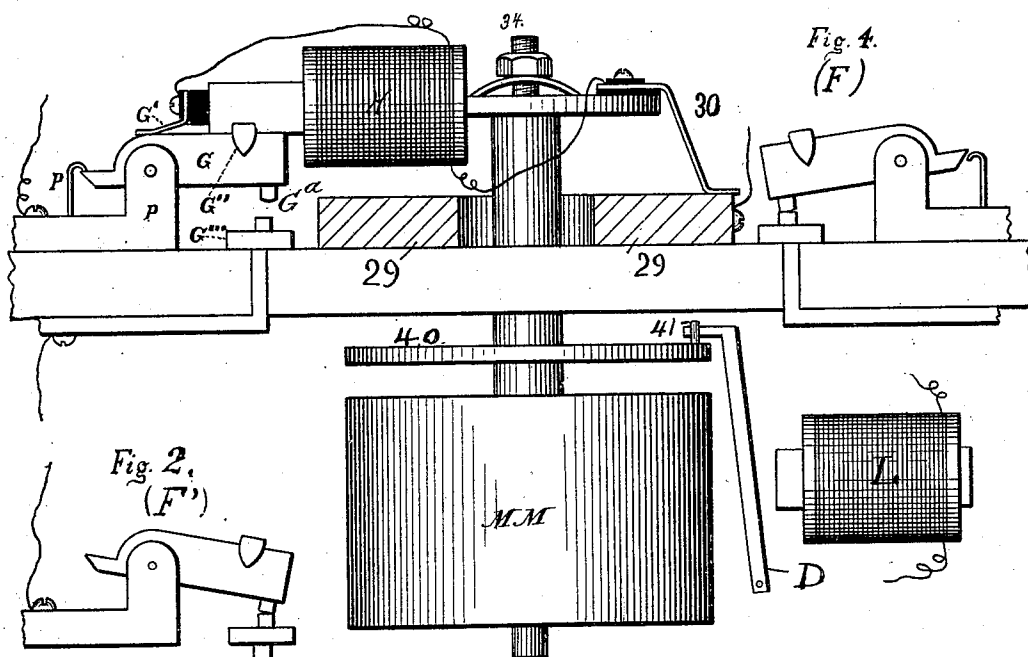
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FELIX BENEDICT HERZOG AND SCHUYLER SKAATS WHEELER, OF NEW YORK, N. Y.; SAID WHEELER ASSIGNOR TO SAID HERZOG.

ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 683,759, dated October 1, 1901.

Application filed January 29, 1886. Serial No. 190,176. (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, in the county of New York and State of New York, have invented certain new and useful Improvements in Electric Signaling Apparatus, (Case No. 31,) of which the following is a specification.

Our invention relates to electrical signaling apparatus generally, and particularly to means whereby several outlying stations may be connected with apparatus at another station or location in such manner that a number of outlying stations may transmit signals or control the circuit of several circuit-controlled devices at the distant stations, and particularly in means whereby a fewer number of such circuit-controlled or receiving instruments may be separately controlled without confusion by any of a larger number of transmitting devices.

It also consists in a new form of automatic variable-signal-transmitting mechanism and in such an arrangement, construction, and combination of devices and parts as is hereinafter set forth.

In the drawings, Figure 1 represents the organization of the system as a whole; Fig. 2, a detail of one of the separate portions of the apparatus at the receiving-station; Fig. 3, an elevation in section of another portion of the apparatus at the receiving-station; and Fig. 4, an elevation in section of still another portion, Figs. 2, 3, and 4 being connected together by circuits, so as to show how they are connected in practice.

Referring to figures in detail, A A A A in the upper part of Fig. 1 represent suitable transmitters at the substation, the one at the left showing the working parts.

F, F', and F'' represent selecting devices at a distant point coöperating with the substations at which the circuit-controllers A and A are placed. Each of these controllers is connected to the distant station by means of a separate wire, as 1, 2, 3, and 4. These wires are as to their connections arranged in a similar manner, and so one only will be considered. The wire leads first to a metal support P''. On the support P'' is pivoted an ar-

mature G. This armature terminates in a contact G a, and when the armature is at its normal position it falls by its own weight, so that this contact touches the lower contact G''. From this contact the circuit leads to a corresponding support P'' on the next selecting-switch (or "selector," as it is also called) and proceeds in like manner to another series of selectors until it reaches the last one, which, as herein shown, differs slightly from the others, for the purposes hereinafter set forth. At this final selector the circuit terminates in a contact on spring 32, and thence when the spring is in its normal condition it passes to a metal ring C C. This ring C C is the first point at which the separate lines going to the various substations meet in a common wire. This common wire is marked 33, and it will be seen that it connects not only with the binding-post contacting with the right-hand side (shown in section) of the ring C C, but also with the binding-post connecting with ring 29, the function of which will be described hereinafter. Each of these selecting devices comprises a central spindle or shaft 34. This spindle is normally restrained from moving by a detent coöperating with armature D of magnet L, as shown in Fig. 4, and when not so restrained is caused to rotate in any suitable manner, as by a motor M M. (Not shown in detail, but assumed to be in the box shown at the lower portion of Fig. 4.) The motor device is not herein shown, as it forms no part, specifically, of the invention. This spindle carries the arm H, consisting of a bar-electromagnet, the outer end carrying a contact-brush G', connected with the helix of the magnet and adjusted to sweep the respective armatures G. The other end of the helix terminates in connections to a contact-brush on the inner end of the arm, and this brush makes constant contact with an inner ring 29. The inner ring 29 is connected to a receiving or alarm device of any suitable nature—such as B and B'—one of these coöperating with each selector, the last selector, however, having its common contact 29 connected with a common wire 33, as already described, and in this wire are placed in series the magnets controlling the respective motors and also the indicator B'', which coöperates with the last

selector. It has been described that for every substation apparatus there is a terminal G on each one of the selectors. These terminals will preferably be arranged at corresponding points in the respective selectors, and however arranged the relative adjustments between these and the contact-sweeping terminals G' of the rotating arms will be such that no two arms will sweep corresponding contacts at the same instant.

The transmitter coöperating with the selectors may be of any desired character, its function, as far as the selectors are concerned, being to control one of these to the exclusion of the other selectors. Its further function as to the respective receivers which coöperate with the selectors is to cause one of these to receive the signal after the selector corresponding to such receiver has been operated to free the other receivers from any possible future control by that transmitter. As to its first function—that is, for bringing a selector into coöperation with the circuit-controller or transmitter—the device comprises simply means for closing the circuit and continuing the closure for a sufficiently long period of time. As to the second function, a series of impulses will cause the control-indicator to indicate the corresponding signal.

The transmitter or circuit-controller which we here illustrate as a type of the one which may be used where required in connection with the other apparatus shown is constructed and operates as follows: A in Fig. 1 represents generally a suitable base on which is mounted a gearwork comprising a main arbor R R, a main gear-wheel R' on that arbor, and a set of coöperating gears terminating in an arbor which supports the cam U. A suitable spring (not shown) is adapted to be wound up as in ordinary clockwork whenever the handle R R R is turned in a clockwise direction. The operator as soon as he has turned this far enough releases it, whereupon the spring, which has been wound by the act of this setting, will unwind, thereby causing the gearwork to run down, and thus driving not only the last arbor and with it the cam U, but the first or main arbor, on which is also supported the cam R. The ratio in the gearing will be such that the last spindle, the one carrying the cam U, will rotate a given number of times for one rotation of the main arbor. When the apparatus is used to transmit a determinate number of distinct impulses, this ratio will be such that the small cam will rotate not only a number of times corresponding to the maximum number of impulses to be sent, but an additional number equal to that time which will be taken up by the pause to be described hereinafter. The cam R on the main spindle carries an insulating-block S in such position that at the normal position of rest of the mechanism this block will just touch the point V of the spring S, and thus cause a lower point W on the same spring to

clear the lower cam; but the projection of this insulating-block, taken in connection with the adjustment and resiliency of the spring S, is just enough so that when this block is not in position to lift the spring at the point V this point will contact with the outer face of the cam R, while the lower point W on the spring will at the same time contact with the face of the small cam U. The circuit passes through the contact-spring to the gearwork by way of these two cams and in no other way and thence out to line. Therefore in a position of rest, when the insulating-block on the cam R lifts the spring S clear of the cams, the circuit is normally open, and it is automatically closed as soon as the operator moves the pointer. A suitable dial, as is indicated in the other squares at the side of the apparatus here described, may be added, so as to facilitate the work of the operator in setting, but is obviously not essential. A suitable stop will preferably be placed at some point to hold the mechanism in its normal position with sufficient pressure on its main spring to produce the result of returning the gear to its normal position after operation. To set the apparatus, the operator rotates the pointer at least far enough to cause the narrow face of the cam to traverse the point V and as much farther thereafter as will produce the desired number of rotations of the cam U on the last spindle. During the passage of the face of the large cam under the contact-spring the circuit will be closed continuously at this point. Although the lower point of the brush will be thrown out of engagement with the smaller cam during each rotation of that cam, this break will of course not be noticeable in the circuit, because the contact between the long cam and V short-circuits this break. As a result of this arrangement a continuous closure will be produced during the rotation of the face of the large cam opposite the point V, and a series of breaks will be produced while the notch on the large cam is opposite the point V, because during this time the small cam rotates and makes the circuit while its face engages with the lower point of the spring and breaks it when the depressed portion engages with this lower point. Various details of the box—such as the gears, pinions, clicks, and ratchet or device for producing a uniform rate of rotation necessary to make commercial forms of impulse-producing boxes—are not explained at length, as they form no part of this invention and are shown in all the well-known types of district-telegraph boxes, of which the present is merely a modification. Obviously if the transmitter is required merely to signal or produce a control in which characteristic sequences of impulses are used, as in district-boxes, any suitable device may be added.

The result of the operation described will affect the receiving apparatus as follows: During the first portion of the act of setting the face of the large cam will produce a long

closure, and the parts are so proportioned that this closure will be long enough to enable the selector to perform its function—that is, it will be able to make at least an entire revolution—and therefore the impulses produced by the small cam in the transmitter after the mechanism is permitted to run down during the recoil of the mainspring will thereafter control whatever mechanism may be used, as the controllable apparatus, which in the drawings is typified as an indicator B, but which may obviously be any other mechanism. After the main arbor has been carried back enough to cause the face of the large cam to again make contact with the point V of the spring a second long closure will result and continue until the apparatus returns to its normal position of rest. In the selector or other apparatus at the receiving-station here shown no use is made of this second closure, and it has no effect whatever. The main point to be considered is that prior to the return of the transmitting apparatus to its normal position of rest its impulses will have been produced and that prior to this production and during the act of setting the raised portion of the cam R will have made continuous contact with the point V during the first operation of setting. This closes the circuit long enough to permit of the operation of the distant-station apparatus in a manner now to be described. Normally the battery E and the cooperating circuits are not in action. As soon as at the first operation of any of the distant stations any circuit is closed in the manner described the current will flow from the battery through the common wire, thence to the contact-spring of the operated transmitter, thence through the metallic portion of the cam R and the rest of the movement, thence along the operated individual circuit, such as No. 1, thence to the support P' of the first transmitter, thence, as already described, until it reaches the common wire 33 of the last selector, thence through the magnets in series of the three selectors, thence through the indicator B' and by the common wire back to the battery. Magnet L and the corresponding magnets of the other selectors control armatures which when at rest block pin 41 on wheel 40, fixed on spindle 34. As the current energizes the magnets the armatures withdraw from the path of the pin and the shafts are free to revolve and the arms H begin to revolve, sweeping every armature in turn. As each brush revolves the effect will differ according to whether the armatures touched belong to a line the transmitter of which is closed or open. Inasmuch as all of the lines are connected together beyond the last selector it follows that any brush touching any contact will get current not only while the line corresponding directly with a given closed circuit, but while any other circuit is closed and will thus energize the helix on its rotating arm and so lift every armature as it reaches

it; but when armatures which do not belong to an operated line are attracted they break the circuit which carries the current which energizes the sweeper-arm, but no further effect is produced, because the relative adjustments are such that the momentary closure described will not produce the effect that a full closure would produce, in that it will neither operate the indicator-magnet nor act to clutch the rotating arm nor lock the armature. The maximum and therefore the fully effective attraction of an armature can only occur during closure of its own line, because although as it is lifted it breaks the line beyond, yet the current will short-circuit this break by flowing through the helix and the indicator belonging to the operated arms. As the armature is lifted its full distance its outer end pushes aside and then catches in the spring P, Fig. 4, and a lug G'', carried by the armature on its farther side, locks the arm, so that it cannot go farther during the breaks due to operation of the transmitter which sends intermittent impulses to line. The magnetic arms of the selectors are connected to the spindle by a friction-bearing, consisting of the nut, screw, and spring-washer shown, thus permitting the arms to be carried along when they are not clutched and at the same time permitting the motor to complete its revolution after each release and after the arm is clutched. In this manner each selector or arm is independent of the others, there being no mechanical connection between them. As a result the selector which may by its arm have first touched an operated contact will secure the control of a line corresponding to the same, and whatever the effect designed it will be produced by the corresponding apparatus at the substitution on that line, and this selector will be controlled or will control that apparatus, as the case may be, to the exclusion of the other selectors and apparatus corresponding therewith. In the form here shown the control of the transmitter at the different stations will be exercised upon the element B, B', or B'', as the case may be. The details of this apparatus are not shown herein, as they form no part of the present invention, and the diagram merely typifies any suitable apparatus. Considered with reference to carrying out one portion of the invention—namely, that by which a smaller number of receiving instruments may be separately and without confusion operated by any of a far larger number of transmitting instruments—the number of selectors in a system should be made such as to equal the maximum number of transmitting instruments which would probably be operated at any one time, and whatever the number of these may be each will in the manner described operate to secure control of a particular line and prevent the cooperation of that line and any of the other selectors, although any one of them might have been called into operation at a

time when it would cooperate with any one of the lines:

The last selector-switch F'' differs from the others in that the contact-terminals are so organized that as the rotating arm sweeps by them it momentarily lifts them from their lower contacts and also in that these lower contacts are all normally connected together by way of the metal ring C C, which is touched by each spring in its position of rest. This ring connects with return-wire, thus enabling the circuit to be completed as soon as it is closed at any substation. The arm of this last selector terminates in a metal roller 31, which operates both to press the individual springs 32 away from their common contacts to C C and at the same time to close the connection between the individual lines and the helix. The ring C C is of iron, and when a sufficiently strong current passes through the helix its projecting pole-piece or core will become magnetized sufficiently to cause the arm to be clutched by attraction downward to the iron ring C C. This energization, however, would only take place after the current will have broken contact between 32 and C C, because until that occurs the helix will be short-circuited by the common wire connecting ring C C with 33.

It is to be noticed that the last selector F'', which is nearest the battery, is used merely to point out the circuit which operates the last receiver.

We do not mean to confine ourselves to the details of construction shown, and the various parts may be widely varied without departure from our invention.

We claim—

1. In a signaling system, circuit-controllers at two or more substations, and at a central station, receiving mechanisms, each controlled by a magnet, each normally controllable from either substation, together with a circuit to each substation; the magnets which control the receiving mechanism being fewer in number than the number of these circuits; and automatically-operated devices common to the circuits connecting with the receiving-station, and acting, when one distant apparatus has secured control, to prevent interference from another station.

2. Two or more commutators; connections between their respective corresponding sections, and corresponding circuit-controllers at signaling-substations; a controlling device—as an arm for each commutator adapted and arranged to cooperate with its sections, connections therefrom cooperating with a controllable device for each; for each arm a guide and support, and means for moving the arm as permitted by the guide and support to an extent not predeterminable at will from an operated substation.

3. A signal system comprising circuit-closers at two or more distant stations, said closers including devices whereby the circuit

will be reopened, after a sufficient length of time, without the act of the operator; circuit connections to two or more controlled devices, each of these comprising shifting devices, the whole operating so that a circuit-closer which has obtained the control of one of the receiving devices will have its circuit connection shifted out of cooperation with the other circuit; together with means arranged to permit the simultaneous cooperation of such connected pairs of receivers and controllers without confusion.

4. A signaling system comprising a number of circuit-controllers at different stations, connections to a central station, and at the central station signal-receiving devices comprising controlling-electromagnets fewer in number than the number of distant station-controllers, and comprising also shifting mechanism, the whole acting to enable any distant circuit-controller to control one of the receiving-electromagnets and thereafter acting to cut such a magnet out of control of other stations; the particular receiving-magnet thus controlled from one station varying with the time or order of control from other stations.

5. Two or more selectors, each containing, first, a commutator of corresponding contacts, respectively arranged to cooperate with separate circuit-closers controlled at substations; second, a connection to an indicating device; third, a switching device arranged to sweep the commutator; and fourth, means whereby the relative time of contact between the different switching devices and the respective contacts corresponding to any given substation determines which of the several indicating devices shall effectively cooperate with the circuit-closer corresponding to a given substation which has been operated.

6. Two or more controllable devices, each arranged and adapted to cooperate through suitable circuits with each of a larger number of controlling devices located at substations; intermediately-located controlling-selectors less than the number of controlling devices; and means, including switch mechanism controlled by the selectors and arranged to predetermine the order in which the controlled devices will be operated.

7. A signaling system comprising several circuit-controllers at substations; several receiving devices each arranged and adapted to be possibly brought into cooperation with any of the operated substations; several selectors, each comprising a fixed contact corresponding to each of the substations, and a cooperating movable contact controlling one of the receivers; together with means whereby the receiver corresponding to the movable contact which first cooperates with one of the fixed contacts which corresponds to a given operated substation, will be controlled thereby.

8. A circuit-controller at a signaling-point, connections to several contacts each cooper-

ating with a different switch, means for moving the switches independently, and receiving devices controlled by the respective switches and each adapted to be controlled from the signaling-point only when its own switch sweeps the corresponding contact.

9. A circuit-closer at a signaling-point; connections to several contacts each cooperating with a different switch; means for moving the switches independently, and receiving devices controlled by the respective switches and controllable by the circuit-closure at the signaling-point only when its controlling-switch makes the contact; together with means whereby no other receiving device can be similarly affected thereafter.

10. The combination of two or more impulse-producing controlling-transmitters; two or more devices severally controllable thereby and two or more intermediately-placed selectors; together with means arranged and adapted to prevent interference in the operating of two simultaneously-operated transmitters; all cooperating so that the respective controlled and controlling devices are connected in pairs in an order determined by the order of operation of the transmitters.

11. The combination of a number of impulse-producing transmitters; a smaller number of devices severally controllable thereby, and two or more selectors, each comprising a contact for each transmitter, and connections; all operating to cause one of the controllable devices when idle to be switched into circuit with an operated transmitter, and during such connection to permit other controllable devices to remain subject to control by other transmitters.

12. The combination of a circuit-controller and a circuit leading therefrom; a number of controllable devices severally arranged and adapted to be effectively controllable by the controller; a movable element for each controllable device, arranged with adjustment whereby their respective movements are not necessarily made in unison; a set of switches cooperating with the controller, any one of the switches of the set being arranged and adapted to be brought into effective cooperation with any controllable device, but with only one of the said movable elements; all cooperating so that the controller is made to cooperate with that one of the controllable devices which belongs to the movable element first cooperating with its unit.

13. The combination of a circuit-controller and a normally open circuit leading therefrom; a number of controllable devices severally arranged and adapted to be effectively controllable by the controller; a movable circuit-closing element for each controllable device arranged so that their respective movements are not necessarily in unison; a set of contacts cooperating with the controller through suitable circuit connections, each contact of the set being arranged and adapted to

be brought into effective cooperation with any controllable device, but with only one of the said movable elements; all cooperating so that the controller is made to cooperate with that one of the controllable devices which belongs to the movable circuit-closing element first reaching one of the contacts, and thus completing the circuit to line.

14. The combination of several circuit-controlling devices at substations; several controlled devices located elsewhere; intermediately-placed selectors, including a movable element, a guide for the same, and means for moving the element with respect to the guide and independently of any operator at the selector location; switches arranged in sets, respectively special to a given controlling device, each switch of such set being located at a different selector; the whole cooperating so that one of the controlling devices, when operated, will be brought into cooperation with a controlled device automatically selected by reason of the occasional cooperation of a given selector with any one of the said units, and not by reason of any prearranged permanent assignment.

15. The combination of several circuit-controlling devices at substations; several controlled devices located elsewhere; intermediately-placed selectors, including a movable element, a guide for the same, and means for moving the element with respect to the guide, and independently of any operator at the selector location; switches arranged in sets respectively special to a given controlling device, each such switch of such set being located at a different selector; the whole cooperating so that one of the controlling devices, when operated, will be brought into cooperation with a controlled device, automatically selected by reason of the occasional cooperation of a given selector with one of the said units, and not by reason of any prearranged permanent assignment; together with means arranged to secure a second normally effective cooperation of another idle controlled and idle controlling device during the time of cooperation between one such pair and without interfering therewith.

16. The combination of several circuit-closers at substations; several controllable devices located elsewhere; intermediately-placed selectors, including contact-blocks arranged in sets respectively special to a given substation; each contact of such a set being located in a different selector, and means, independent of the operator, for selection of the substation and joining a given controllable device to the substation; the whole cooperating so that one of the closers, when actuated, will be brought into cooperation with a controllable device, selected by reason of the occasional cooperation of its selector with one of the said units, and not by reason of any prearranged permanent assignment.

17. The combination of several circuit-controlling devices at substations; several controllable devices located elsewhere; intermediately-located and connected selectors, including contacts arranged in sets respectively special to a given controlling device, each unit of such sets being arranged especially for coöperation with a given selector together with an automatically-operating switch for each set arranged to cut out of operation all units of a set except the first one controlled, the whole coöperating so that one of the controlling devices, when operated, will be brought into coöperation with a controlled device, selected by reason of the occasional coöperation of its selector with one of the said units, and not by reason of any prearranged assignment, together with means whereby a second normally effective coöperation of another idle controlled and an idle controlling device may take place during the time of coöperation between one such pair, and without interfering therewith.

18. The combination with a controllable or receiving apparatus adapted and arranged to respond to the actuation of any of a number of controlling devices at substations, of a selector for producing coöperation between the receiver and a controlling-station, and including a movable element—as a brush—and two classes of contacts respectively corresponding to substations—those of one class consisting of terminal blocks arranged and adapted to be swept by the brush, and those of the second class consisting of a switching-contact or pair of elements arranged to be separated at a time corresponding to that when the brush sweeps a corresponding terminal block.

19. The combination with a controllable or receiving apparatus adapted and arranged to respond to the actuation of any of a number of controlling devices at substations, of a selector for producing coöperation between the receiver and a controlling-station, and including a movable element—as a brush—and two classes of contacts respectively corresponding to substations—those of one class consisting of terminal blocks arranged and adapted to be swept by the brush, and those of the second class consisting of a switching-contact or pair of elements arranged to be separated at a time corresponding to that when the brush sweeps a corresponding terminal block, and including an armature adapted to be magnetically moved.

20. The combination with a controllable or receiving apparatus adapted and arranged to respond to the actuation of any of a number of controlling devices at substations, of a selector for producing coöperation between the receiver and a controlling-station, and including a movable element—as a brush—and two classes of contacts respectively corresponding to substations—those of one class consisting of terminal blocks arranged and adapted

to be swept by the brush, and those of the second class consisting of a switching-contact or pair of elements arranged to be separated at a time corresponding to that when the brush sweeps a corresponding terminal block, and including an armature adapted to be magnetically moved; together with a device—as a catch—for subsequently maintaining the separation.

21. The combination with two receiving devices, each adapted and arranged to respond to the actuation of any of a number of controlling devices at substations, of intermediate mechanism comprising two selectors each including a movable brush and contacts respectively corresponding to the substations, and adapted to be swept by their respective brushes, together with, for one of the selectors, a set of switching-contacts also corresponding to the stations, and including connections to the contacts of the other selector; said substation-contacts including means for separating them when the brush of that selector reaches a position characteristic of a corresponding substation, and means to maintain the separation; whereby the second receiver is cut off from subsequent coöperation with the corresponding substation.

22. The combination with two receiving devices, each adapted and arranged to respond to the actuation of any of a number of controlling devices at substations, of intermediate mechanism comprising two selectors each including a movable brush and contacts respectively corresponding to the substations, and adapted to be swept by their respective brushes, together with, for one of the selectors, a set of switching-contacts also corresponding to the stations and including connections to the contacts of the other selector; said switching-contacts including an armature carrying a contact adapted to be separated magnetically from a fixed contact when the brush of that selector reaches a position characteristic of a corresponding substation, and a catch to maintain the separation; whereby the second receiver is cut off from subsequent coöperation with the corresponding substation.

23. A selector, including a commutator or group of contacts, each corresponding to a substation at which there is a signaling or controlling element; a second selector including corresponding contacts; connections between these contacts which, in the respective commutators, correspond to a given substation; a separate receiver or controllable element for each commutator; for each such controllable element a movable device—as a contact-brush—adapted and arranged to coöperate in succession with the contacts of its commutator; together with shifting mechanism arranged and adapted—after that one of the brushes which first reaches a contact corresponding to an operated substation has con-

5 nected a receiver thereto—to cause the subsequent junction between the other brush and the corresponding contact in the other commutator to fail to so connect a receiver; whereby either receiver, but only one of the two, is adapted to be controlled as the result of operation from any substation.

Signed at New York, in the county of New

York and State of New York, this 27th day of January, A. D. 1886.

F. BENEDICT HERZOG.

SCHUYLER SKAATS WHEELER.

Witnesses:

HOFFMAN MILLER,

DAVID S. UPDIKE.