

No. 628,464.

Patented July 11, 1899.

F. B. HERZOG.

ELECTRIC SIGNALING APPARATUS AND CIRCUIT.

(Application filed Oct. 25, 1894.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

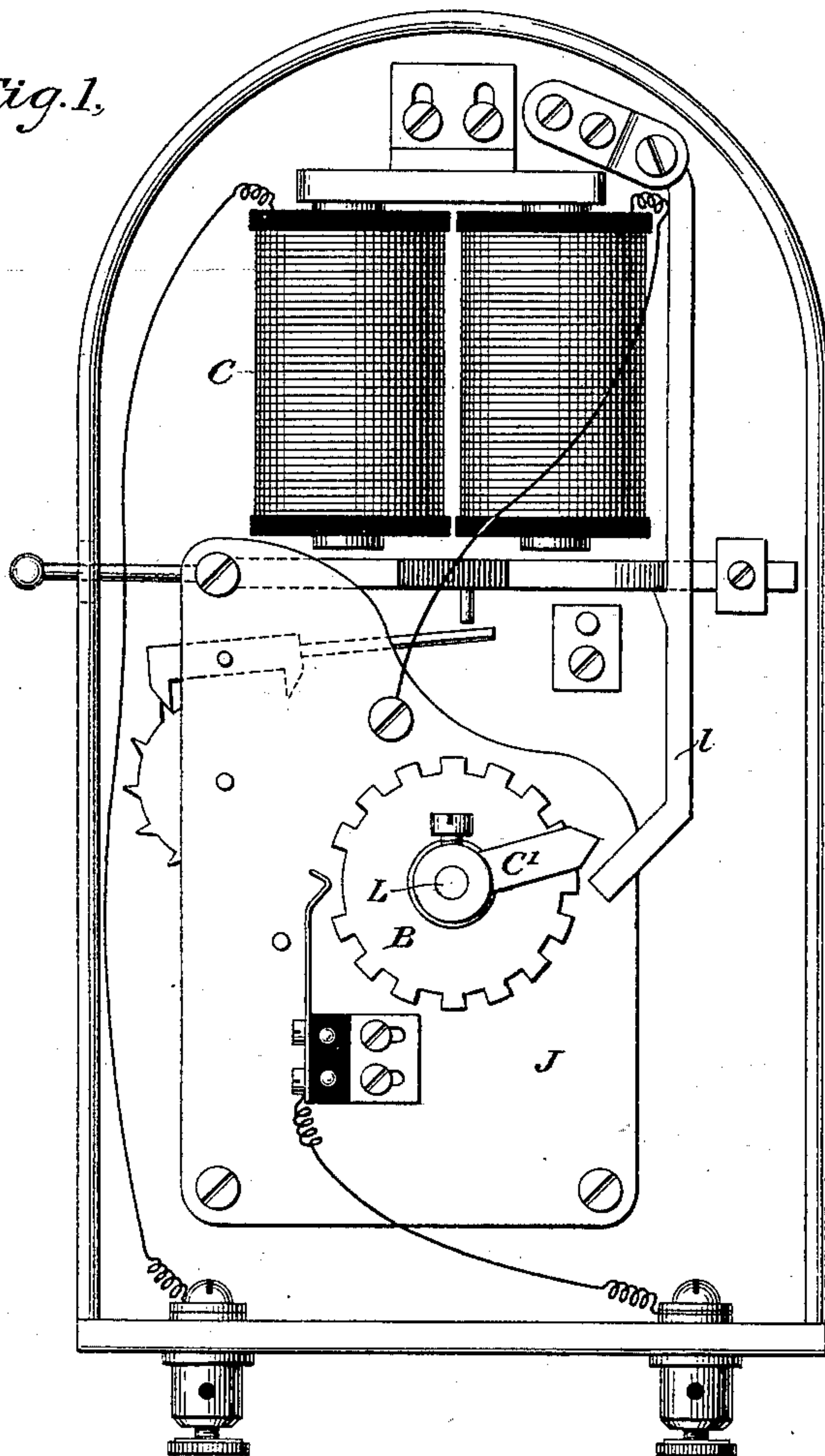
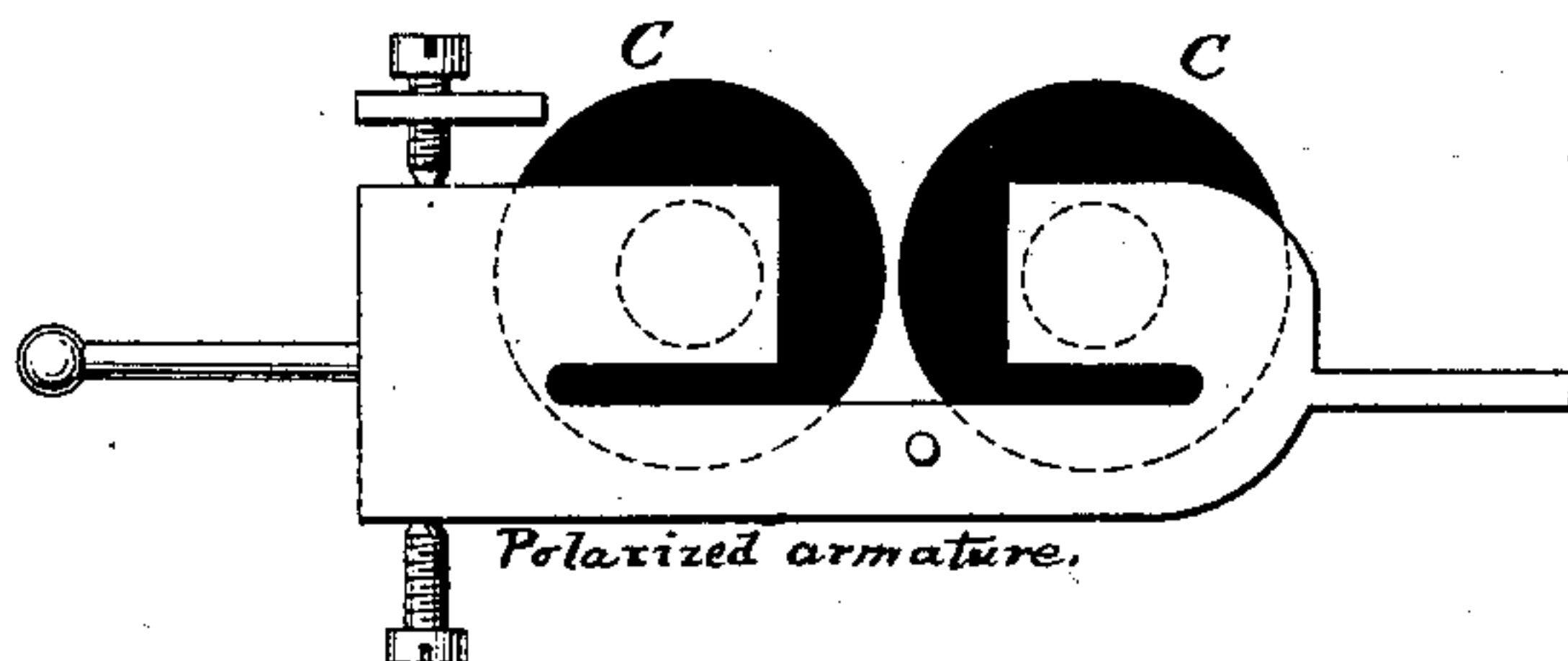


Fig. 2.



Witnesses

Geo. W. Brock.
Geo. Dickman Curtis.

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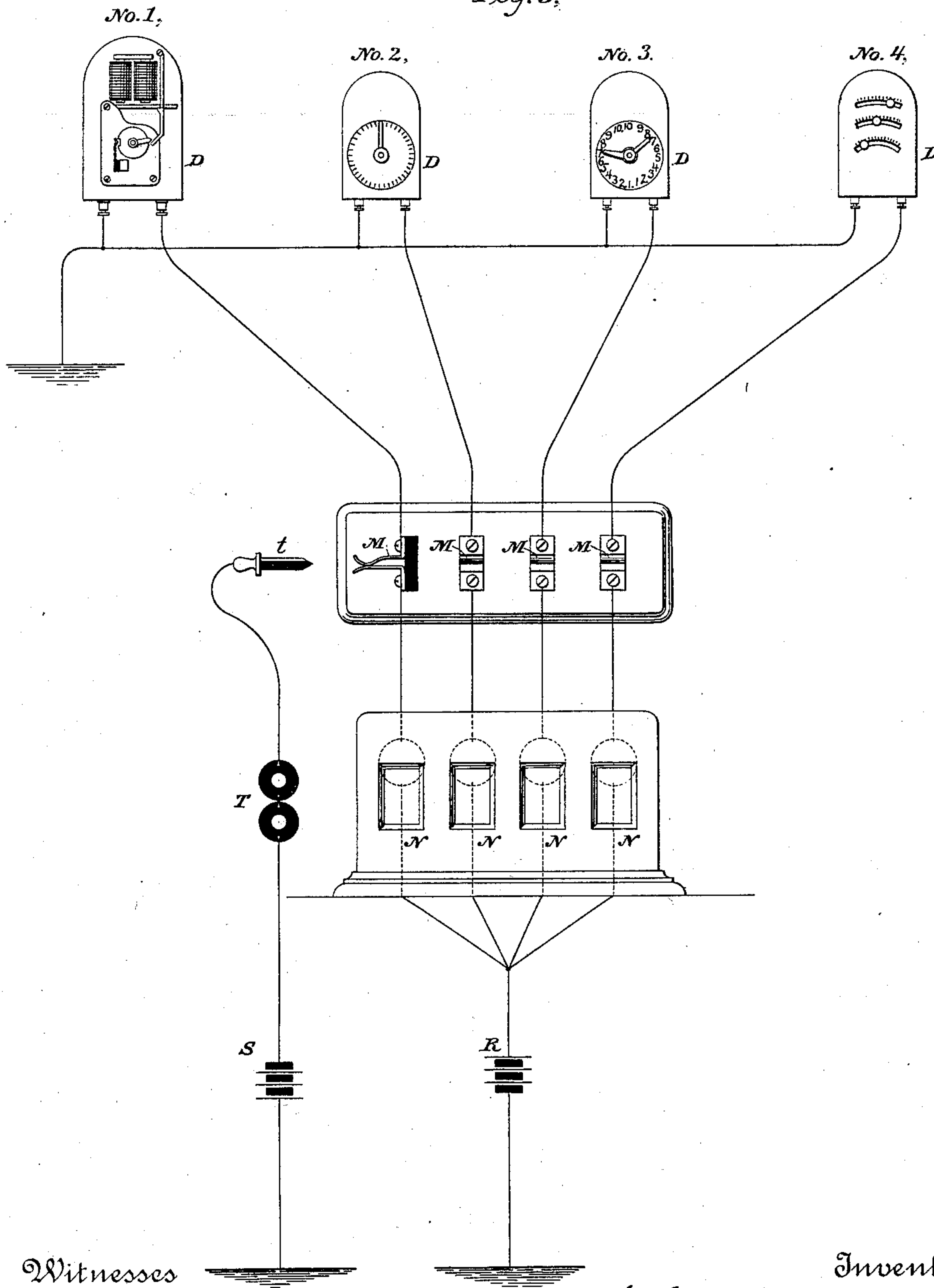
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2 Sheets—Sheet 2.

Fig. 3.



Witnesses

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UNITED STATES PATENT OFFICE.

FELIX BENEDICT HERZOG, OF NEW YORK, N. Y.

ELECTRIC SIGNALING APPARATUS AND CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 628,464, dated July 11, 1899.

Application filed October 25, 1884. Serial No. 146,447. (No model.)

To all whom it may concern:

Be it known that I, FELIX BENEDICT HERZOG, a citizen of the United States, residing at New York, in the county and State of New York, have invented a new and useful Improvement in Electric Signaling Apparatus and Circuits, of which the following is a specification.

In Letters Patent No. 289,834, issued to me December 11, 1883, I have described an automatic signaling apparatus applicable to many different uses, such as telephone-exchange service, district-telegraph and private circuits, hotel-annunciators, &c., the main feature of which is that the apparatus may be properly set by a person desiring to signal to a distant point and is so constructed that the desired signal is not transmitted at the moment of setting the instrument, (as is the case in instruments of the kind known as "transmitters,") but the apparatus retains the signal as set until it is released directly or indirectly from a distant point by the person who is to receive the signal at the moment he is ready for it, when the signal is automatically transmitted to such receiver. These instruments being capable of being set so as to transmit alterable signals or combinations of signals enable the sender to convey any desired information to the receiver, the time of receiving such signal, however, being entirely under the control of the receiver. In this and contemporaneous applications I shall call such instruments "latent-signal transmitters." My present invention relates principally to the application of such apparatus to telephone-exchanges, hotels, and private circuits, though parts of the invention are applicable to any circuits; and its main feature consists in providing the guest's room with such an instrument whereby he can at pleasure signal to the hotel clerk his various wants, and in so combining and connecting these separate instruments with means for releasing them and receiving the signals controlled by the hotel clerk or receiving person that, if desired, the mere act of setting any guest's instrument automatically operates an annunciator at the receiving end, so as to inform the clerk that the particular instrument has been set, and that thereupon the clerk, as soon as prepared to receive the signal, can, by making certain

connections, introduce a receiving instrument, release the guest's signal instrument, and thus receive the guest's signal at pleasure. By this invention if two or more guests should happen to set their instruments at the same time or before another had finished sending the signal it is impossible that their signals should interfere with each other however many may be set at once, because each instrument retains its signal when set until the clerk is ready to receive it, when he releases and receives the signals one after the other of those which the annunciator shows.

My invention further consists in an arrangement applicable to any circuit, whereby the act of setting the signaling instrument (and closing its own circuit with a battery in the circuit) is prevented from releasing the instrument so that it will not remain set, but, on the contrary, the instrument can be set and will remain so, even though the circuit is closed at the time of setting.

It consists, furthermore, in an arrangement by which when a circuit is closed in the guest's room it remains closed until it is opened by the action of the clerk, thus making it impossible to restore the annunciator-drop to its normal condition without having noted the number, thus obviating a source of much confusion. This opening of the circuit, moreover, is so arranged as to serve as a return-signal to the guest and to indicate to him that his call has been noted.

My invention also consists in certain details of construction of the transmitting instrument and in certain arrangements of circuits hereinafter described.

I shall describe my invention chiefly as applied to hotel purposes; but it is equally applicable to telephone-exchange systems or other circuits.

In the accompanying drawings, Figure 1 represents a front view of a signaling instrument constructed according to my invention and substantially as described in my patent before referred to. Fig. 2 is a bottom view of the armature of the electromagnet. Fig. 3 represents my invention as applied to hotels and other similar uses.

My latent-signal instrument being fully described in my previous patent and in a pending application filed by me in the Patent Of-

fice September 29, 1884, Serial No. 144,194, it is only necessary here to say that it consists of a character or break wheel B, driven by an ordinary clockwork-transmitter J, the escapement of which is controlled by an electromagnet C, as shown and as fully described in the application filed September 29, 1884.

In Fig. 1 I have shown two independent devices for keeping the armature of the electromagnet out of engagement with the escapement-pendulum G when the instrument is unwinding and sending its signal, which would otherwise stop the clockwork at each break of the circuit produced by the instrument itself in sending its signal. One of these devices consists of a hanging lever or catch *l*, which serves to hold up the armature out of the way of the escapement except when the instrument is being set, when the arm *C'* kicks the lever *l* aside and allows the armature to drop and lock the escapement, this construction being described and claimed in the application filed September 29, 1884. The other device for holding the escapement unlocked except when the instrument is set, which may be used alone or in connection with the first-described device, consists in providing the electromagnet C with a polarized armature. I therefore make the armature a permanent magnet mounted in trunnions attached to the frame of the instrument, so that it will be attracted by a current of one polarity only. The armature being permanently magnetic normally attracts itself to the electromagnet when no current is in circuit, so as not to lock the escapement, and consequently during the breaks of the circuit it does not drop down and stop the clockwork. At the time the instrument is set—that is, when the circuit is in its normal condition—the battery in circuit is of polarity to repel the armature, and therefore when the instrument is set and the circuit closed the armature remains down and locks the escapement until the current is reversed by the receiving operator. This reversal causes the armature to be attracted and so releases the escapement. During the breaks the permanent magnet clings to the iron core of the electromagnet. This device dispenses with the necessity for any other contrivance, such as the catch *l*, for holding the armature out of engagement with the escapement when the instrument is sending its signal.

It will be understood that the transmitter is set by means of a hand on the outside of the box, attached to the break-wheel spindle, and the instrument may be provided with a second hand for limiting the revolution of the first hand, as fully described in the patent before referred to.

I will now explain my invention as applied to hotels.

D D D D represent separate latent-signal instruments constructed as I have described, one being placed in each guest's room. Each instrument is connected by a separate wire

with the receiving-station or clerk's office and each circuit leads through a separate spring-jack M and an annunciator N, after which the circuits join and lead through a battery R to the ground. In a separate circuit are placed a battery S, opposite in polarity to the battery R, and a sounder T. This circuit terminates at one end in the ground and at the other in plug *t*, one side of which is insulated, as shown. The apparatus is represented as in its normal condition and all the separate circuits are open at the guests' instruments, a notch in each break-wheel being under the contact-springs, as shown in both Figs. 1 and 3. When any guest sets his instrument, it closes the circuit and drops the annunciator-drop corresponding to that instrument and room, thereby making the clerk aware that that instrument has been set. It is to be observed that the instrument remains locked when set, for the reason that the polarity of the current in circuit is such as to repel the armature and make it lock the escapement. The circuit is thus closed at the room and remains so closed until the clerk opens it again by his action in releasing the latent signal. The annunciator may be provided with a continuous ringing arrangement to call attention, but in any case will prevent the drop from being raised inadvertently before the number is noted, as if so restored it will drop back again until the circuit is again opened at the room by proper means. The clerk thereupon inserts the plug *t* in the proper spring-jack, and the battery S, being of opposite polarity to the battery R, causes the guest's instrument to be released and transmit its signal, which is received by the clerk on the receiving instrument T, for which purpose a sounder or bell may be employed to sound or a visual indicator on a register to record the signals received. By this arrangement the clerk is enabled to know when any guest has set his instrument; but the signal so set does not come in until he is at leisure and ready to give it his attention. He then releases and notes it. In case two or more instruments should be set at the same time there is no possibility of the signals interfering with each other, as the instruments are released in succession at the will of the receiving clerk. It is to be noted that the introduction of the plug *t* in any circuit disconnects the corresponding annunciator-drop, since the under side of the plug is insulated and leaves the other annunciator-circuits intact, so that should any other guest set his instrument while another signal is being received it will be shown by the annunciator.

When the clerk releases any latent-signal instrument, the guest is informed of the fact by observing the hand of the instrument or by the noise of the clockwork in unwinding and is thereby assured that his wants are being attended to.

There are other ways in which the annunciator may be dropped by the setting of a

latent-signal instrument without causing the instrument itself to be released at the time of setting—such as by employing different strengths of current, one current not being sufficiently strong to release the latent-signal instrument, though strong enough to operate the annunciator in the well-known manner, or it may be done by having the act of setting the latent-signal instrument cause the circuit to be broken at the receiver's office, as described in the application filed by me September 29, 1884, Serial No. 144,194, or it may be done by having the magnet of the annunciator of so high a resistance as compared with that of the latent-signal transmitter that the latter will not operate with the normal strength of current until the former is cut out of circuit. All of the above modifications are shown in case Serial No. 248,362, filed August 31, 1887, which as to some of the features of the present application is a continuation and division of the same.

In the drawings I have shown four separate circuits provided with guests' latent-signal instruments; but of course any number can be worked in precisely the same manner. The spring-jacks may be inserted before or after the circuit has entered the annunciator, and any form of spring-jacks or of circuit-changing devices M or of annunciators may be employed. Of course there is no objection in having the annunciator-drop magnet left in circuit other than that it increases the resistance of the circuit. The signal may be received, sounded, indicated, or recorded in any desired manner. Magneto-generating machines or currents derived from dynamo-circuits may be employed instead of the batteries shown, and the additional battery S may be dispensed with, and the battery R employed also to release the guests' instruments by properly reversing it in the circuit of the instrument to be released.

Instead of calling the central operator and having the instrument released send in its signal on the same circuit the receiving operator may be called or informed that a latent signal has been set upon another circuit separate from the circuit by which the instrument is released and sends in its signal, which arrangement I make the subject of a separate application for a patent, Serial No. 155,873, of February 14, 1885.

The latent-signal instruments may be constructed in any desired manner and to transmit a single signal or group of signals.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. Circuit-controllers at several outlying stations; a separate line from each to a common station; each controller comprising normally-separated terminals and means for effectively joining these and so completing the circuit; and means for retaining the circuit closed; together with a restoring-magnet for each line arranged to control its reopening;

and at the common station an annunciator composed of separate annunciator elements for each line, each adapted to respond to the operation of the corresponding circuit-closer; and a separate switching connection for each; whereby each of such distant magnets may be separately controlled from the common station, to reopen the closed circuit and thus restore the indicator of that line.

2. Circuit-controllers for several outlying stations; a separate line from each to a common station; each controller comprising normally-separated terminals and means for effectively joining these and thus completing the circuit; and means for retaining the circuit closed; together with a restoring-magnet for each line arranged to control its reopening; and at the common station an annunciator composed of separate annunciator elements for each line, each adapted to respond to the operation of the corresponding circuit-closer and to remain operated until this has been restored by its magnet; and a separate switching connection for each; whereby each of such distant magnets may be separately controlled from the common station, through its own circuit, to reopen the closed circuit and thus restore the indicator of that line.

3. Circuit-controllers at several outlying stations; a separate line from each to a common station; each controller comprising normally-separated terminals and means for effectively joining these and so completing the circuit; and means for retaining the circuit closed; together with a restoring-magnet for each line arranged to control its reopening; and at the common station an annunciator composed of separate annunciator elements for each line, each adapted to respond to the operation of the corresponding circuit-closer and to remain operated until this has been restored by its magnet; and a separate switching connection for each whereby each of such distant magnets may be separately controlled from the common station, through its own circuit, to reopen the closed circuit and thus restore the indicator of that line; combined with means whereby the circuit though flowing through the restoring-magnet and annunciator element when their corresponding line has been closed will operate the annunciator but not the restoring-magnet until the corresponding switch has been operated.

4. A signaling system comprising a number of substations; a circuit-controlling device for each station, comprising a normally-separated pair of terminals to a connection leading to another point; means for joining these terminals and for keeping them joined; a restoring-magnet included in the line when the terminals are joined, and adjuncts located and adjusted so that the magnet controls the restoration of the normal condition of the circuit; separate connections from each of several such circuit-controlling devices to a common point, at which there is a separate switching device for each such connection, together

with a common current-supply, a common indicator and a common connection, adapted and arranged to be joined with the several switching devices of the separate connections, one at a time; whereby the actuated circuits may be separately reopened by their magnets, through their lines, and the common indicator will be operated in connection with each such actuated circuit.

5. A signaling system comprising a number of substations; a circuit-controlling device for each station comprising a normally-separated pair of terminals to a connection leading to another point; means for effectively joining these terminals and for keeping them joined; a restoring-magnet for the pair of terminals and adjuncts located and adjusted so that the magnet controls subsequent separation thereof; separate connections for each of several such circuit-controlling devices to a common point at which there is a separate switching device for each such connection; together with a common current-supply and a common indicator and means for joining these to the several switching devices, one at a time; together with means for securing, as an entire operation which can be repeated and completed in sequence for each actuated substation, the control of the common receiver by the substation signaling device which has been thus connected thereto, and the permanent restoration, by its magnet, of the normal circuit conditions thereof.

6. A signaling system comprising a number of substations; circuit connections for each substation comprising at one point a signaling-terminal which is adapted to cooperate in the preparation of the signal, and at another point a switching device adapted to cooperate in a restoration to the normal conditions; means for uniting any terminal of the first-named class to a suitable return connection and for keeping it so joined; a restoring-magnet for each substation adapted and arranged to cooperate in the restoration of the original conditions; together with a common current-supply, a common indicator and means whereby these may be brought into cooperation with the separate switching-terminals, one at a time; together with means for securing, as an entire operation which can be repeated and completed in sequence for each actuated substation separately, the control of the common receiver by the substation signaling device which has been thus connected thereto, and the permanent restoration, by its magnet, of the normal conditions thereof.

7. A signaling system comprising a number of substations for each of which there is a pair of separated circuit-terminals, a restoring-magnet, and a separate line; and an annunciator at a central station with an independently-operable annunciating element corresponding to each station and line; means for joining each pair of terminals and for keeping it joined, until it is reopened by its magnet; separate switching connections for the

lines; a common current-supply and switching devices, arranged to cooperate in one operation for each line, with the switching-terminals of the said lines, their restoring-magnets and their independent annunciator elements and thereby to reopen the corresponding circuits and restore the corresponding actuated annunciator elements; whereby the annunciator will show at any time what circuits have not yet been reopened.

8. A signaling system comprising a number of substations for each of which there is a pair of separated circuit-terminals, a restoring-magnet and a separate line including the restoring-magnet; and an annunciator at a central station with an independently-operable annunciating element corresponding to each station and line; means for joining each pair of terminals and for keeping it joined, until it is reopened by its magnet; separate switching-terminals for the lines; a common current-supply and switching devices arranged to cooperate in one operation for each line with the switching-terminals of the said lines, their restoring-magnets and their independent annunciator elements and thereby to reopen the corresponding circuits and restore the corresponding actuated annunciator elements; whereby the annunciator will indicate at any time what circuits have not yet been reopened.

9. A circuit-controlling system comprising a number of substations, at each of which there is a normally open circuit including a pair of normally-separated terminals; means for closing them; a magnet cooperating in separately restoring them; a separate contact for each such line at another point; together with a common current-supply and means whereby this may be brought into connection with each of the separate-line switching-contacts; together with means for controlling the current, so that it will control the restoration of the normal conditions of the line of any actuated substation apparatus by way of the switching-contacts of that line, through its magnet, by reopening the substation-terminals.

10. At one station a circuit-controlling device comprising a terminal connected to a single line from a distant station and another terminal for the return connection of the said line—neither terminal being adapted or arranged to connect the single circuit to which they belong with any other line or branch needed for their cooperation; means for keeping these terminals normally separated; means for joining them when their circuit is to be controlled and for energizing the circuit from a suitable current-supply; means for holding them joined; a magnet arranged to be included in the circuit completed by their junction; means controlled by it for reopening the circuit; and at a distant point a device normally in the circuit and responsive to the closure; together with a switch arranged to be operable independently, as to time of

operation of the circuit-controlling device at the first station, so as to control the magnet of that station over its circuit; whereby the responding device will be operated by a closure at the first station and the circuit-controlling device when set may be restored independently from the distant point over the said single wire, to reopen it.

11. A signaling system comprising at each of several substations a circuit-closing device having normally-separated terminals during the position of rest and means for joining these and for holding them joined in the position of operation of the device; combined with a magnet and adjuncts so constructed, adjusted and arranged with reference to the condition of a normal current as not to be affected thereby; at the central station an annunciator with a separate element for each of the lines leading separately from the substations; and a separate cut-out switch-terminal between each such element and its circuit-closer; a source of current-supply common to all the lines and of a character adapted to energize the annunciator elements immediately on closure of the terminals at a substation and to continue this energization as long as the circuit remains closed thereat and the said annunciating element is not cut out; together with a common switching-plug arranged and adapted to cooperate with the several switching-terminals; and means for controlling through it, the substation-magnet of the line switched by the plug.

12. At each of several substations, calling devices—as contacts normally separated and arranged to be joined at will and adjusted to be kept joined, operating while so joined to control the flow of current supplied from a common source; separate connections converging from each such station to a common central station at which there is an annunciator with, for each such substation, an independent annunciating element arranged and constructed to be operable by the current controlled by the actuation of the calling devices at the corresponding substations; an independent device—as a switching-terminal—for each line; means for sending to each substation separately a current of another character or condition through the respective independent switching devices without at that time interfering with the operators at other substations in their control over the flow of the normal current for the actuation of their annunciator elements; together with a device at each substation arranged and constructed to be irresponsive to the current which actuates the central annunciator but responsive to the current controlled by the switching operation at the central station; combined with a second generator brought into action upon the completion of its circuit.

13. At each of several substations a calling apparatus including a circuit-terminal and a manually-operated element cooperating therewith and constructed to have with respect to

the terminal a normal position of rest and one of action; separate lines from these stations to a central station having a separate annunciator device for each such substation and a common connection to a common source of current arranged to be controlled by the change of position of the substation manual element to begin the actuation of the corresponding annunciator device and normally to continue this actuation until the said substation element is again in its position of rest; a switching connection at the central station for each such line arranged during its operation to interrupt the operation of the annunciator element; and cooperating therewith, a circuit connection arranged and adapted to control current of another character or condition; together with a controlled device at each substation arranged to be controllable by the said changed current and to operate as a notification to the transmitting operator.

14. Two or more transmitters, each located at a separate station at which there is no separate calling-current generator, and each including: a variable-signal-transmitting element; means whereby it may be set to transmit any of its signals; normally open terminals for each transmitter and means for joining them and for keeping them joined; a source of current common to the transmitters and connected and arranged to flow through the terminals as soon as the operation is completed at the transmitter; a magnet controlling both the operation of the transmitter and the restoration of the circuit to its normally open condition; the said magnet and terminals cooperating with the return and the single wire leading separately from each transmitter to a common station, these elements cooperating with no other line; and at the common station normally closed connections to the common source of current and means for independently controlling the substation-magnets to control the signals of their respective transmitters and to restore the normally open condition of the separate lines.

15. Two or more transmitters, each located at a separate station at which there is no separate calling-current generator, and each including: a variable-signal-transmitting element; means whereby it may be set to transmit any of its signals; normally open terminals for each transmitter; means for closing these terminals as a part of the operation of signaling by the transmitter; a source of current common to the transmitters; a magnet controlling both the operation of the transmitter and the restoration of the circuit thereat; the said magnet and terminals cooperating with the return and a single wire leading separately from the said transmitter to a common station, these elements cooperating with no other line; and at the common station means for annunciating separately the stations at which transmitters have been set and a receiving instrument and a switch arranged to be in turn connected to all of the actuated

transmitters and to be operated thereby; and means whereby the switch is adapted to co-operate in the restoration of the normal circuit conditions at a transmitter, through its magnet.

16. Two or more transmitters, each including: a variable-signal-transmitting element; means whereby it may be set to transmit any of its signals; normally open terminals for each transmitter and means for joining them and for keeping them joined; a source of current common to the transmitters; means for controlling both the delivery of the signals and the restoration of the circuit to its normal condition through the circuit and including only one wire with one return leading from the terminals—there being one such circuit from each transmitter to a common station; and at that station a switching connection for each line and a common indicator and a common connection adapted and arranged to be brought into coöperation with any of the circuits to receive the signal of its transmitter and to restore the apparatus to its open-circuit condition.

17. Two or more transmitters, each including: a variable-signal-transmitting element; means whereby it may be set to transmit any of its signals; normally open terminals for each transmitter; a source of current common to the transmitters; a magnet controlling both the delivery of the signal and a final separation of the terminals; the apparatus coöperating only with the same return connection of a single circuit leading separately from each transmitter to a common station; and at that station an annunciator comprising a separate annunciating element for each of several such lines; means for controlling separately the operation of the several transmitters; the said annunciator elements being arranged and adjusted with reference to the arrangement and adjustment of the transmitter-magnet so that the normal flow of current from the normal source after closure will be adapted to control the former but not the latter; together with means, including a switch, whereby the current may be changed at will to adapt it to control the magnet to restore the circuit.

18. At each of several substations a variable-signal transmitter including elements constructed to be movable from a position of rest to set the transmitter in condition to transmit any of its signals; separate connections to a central station coöperating with which there is a common source of current, and at which there is an annunciator with an element for each substation, adapted and arranged to be operated by the current from the common source, through the separate lines; and at the substation, means for controlling the current to flow through the corresponding annunciator element, as long as the transmitter remains in a set condition and for ending the flow upon the termination of

the signal; whereby the said element of the annunciator will continue to point out what transmitters have not yet been controlled to release their signals; together with a suitable indicator adapted and connected to receive the signals; of several transmitters in turn, and without confusion.

19. At each of several substations a calling apparatus including a circuit-terminal and a manually-operated element coöperating therewith and constructed to have with respect to the terminal a normal position of rest and one of action; separate lines from these stations to a central station having a separate annunciator device for each such substation and a common connection to a common source of current arranged to be controlled by the change of position of the substation manual element to begin the actuation of the corresponding annunciator device and normally to continue this actuation until the said substation element is again in its position of rest; a switching connection at the central station for each such line arranged during its operation to interrupt the operation of the annunciator element; and coöperating therewith, a plug and cord adapted to be used in turn with all the switching connections and a second connection controlled by the plug and supplying current of another character or condition; together with a magnetically-controlled device at each substation arranged and adjusted to be controllable by the current controlled by the plug and not by the normal current and to operate as a notification to the transmitting operator.

20. At each of several substations a calling apparatus including a circuit-terminal and a manually-operated element coöperating therewith and constructed to have with respect to the terminal a normal position of rest and one of action; separate lines from these stations to a central station having a separate annunciator device for each such substation and a common connection to a common source of current arranged to be controlled by the change of position of the substation manual element to begin the actuation of the corresponding annunciator device and normally to continue this actuation until the said substation element is again in its position of rest; a switching connection at the central station for each such line arranged during its operation to interrupt the operation of the annunciator element, and coöperating therewith, a plug and cord adapted to be used in turn with all the switching connections, and a second connection controlled by the plug and supplying current from a second source adapted to operate a polarized magnetic device; together with a polarized device at each substation arranged and adjusted to be controllable by the current controlled by the plug and not by the normal current and to operate as a notification to the transmitting operator.

21. Two or more transmitters each located

at a separate station at which there is no separate calling-generator and between each of which stations and a common station there is only one wire with one return; a common source of calling-current for each transmitter; a variable-signal element and means for controlling the flow of the common current for calling; and at the central station means for separately indicating and locating the calling operation of each line and station and a separate switching device for each such line; together with a common signal-receiver and means for separately controlling the reception of the signals of the various transmitters by the common receiver.

22. At each of several substations at which there is no separate current-generator; a signal-transmitter comprising signal-varying elements, means for bringing these into cooperation with suitable circuit connections leading to a central station, and a device responsive to control from the central station; a common source of calling-current at the central station; an annunciator arranged and adapted to locate the different corresponding lines which have been operated; an indicator arranged and adapted to receive the signals of any of the transmitters, and separate switching devices combined with means for controlling through them the responsive devices at the several substations; together with means for limiting the cooperation of the signal-indicator to only one transmitter at a time; all arranged and coacting so that one signal may be received on the indicator without interference from the operations of other substations.

23. At each of several substations at which there is no separate calling-generator, a transmitter comprising automatic variable-signal-transmitting elements, a circuit-controlling element and a controllable element; separate connections from each such station to a central station; at this station a signal-receiver arranged and adapted to be operable by any of the transmitters; a separate annunciating element for each such substation; connections to a source of current normally common to the system and arranged to be brought into use during the first step of an operation of transmission; a circuit-changing device arranged to control the use of a different current during a second step in the operation; and means for controlling the operation of the controllable element at a substation to indicate to the operator thereat that the said circuit-changer has been brought into use for the second step of the operation.

24. At each of several substations at which there is no separate current-generator a variable-signal transmitter comprising a signal-varying element and a circuit-controlling element; one main line leading from each station to a central station and only one return from each station to a common source of current; suitable connections at the central sta-

tion for the converging substation-lines and the common source of current; means for noting the location of an operated transmitter; a signal-receiving indicator arranged and adapted to be controllable by any of the transmitters and means for limiting the cooperation between it and the transmitters so that only one at a time can cooperate with it in the delivery of a signal; together with devices cooperating with elements at the transmitting stations and arranged and adapted to control the postponement of the operations at any transmitting-station until the common receiver is again free to cooperate therewith.

25. An electromagnetically-controlled signal-transmitting instrument placed in a circuit, and provided with polarized releasing mechanism whereby it may be released and caused to transmit its signal by means of an electric current of one polarity only sent through the circuit, in combination with a receiving or indicating instrument included in said circuit, capable of responding to a current of the other polarity whereby the latent-signal instrument may be set and the receiving instrument operated thereby, without causing the latent-signal instrument to be released, substantially as described.

26. The combination of the normally open circuit polarized latent-signal-transmitting instruments D D D D placed in separate circuits connecting with a central office, circuit-changing devices or spring-jacks M, M, M, M, annunciators N, N, N, N, and common battery R, with the receiving instrument T, and battery S of opposite polarity, whereby the act of setting any instrument automatically closes the circuit and operates the corresponding annunciator by the battery R, and the instrument remains set until the current through its circuit is reversed by the substitution of the battery S, which releases the latent-signal instrument, substantially as described.

27. A circuit-closing instrument in a normally open circuit, provided with a circuit-restorer whereby when the instrument is set and the circuit closed it may be released so as to reopen the circuit by means of a current of a certain condition sent through the circuit, in combination with an annunciator; a current-changing device and battery included in the said circuit, whereby the setting of the instrument operates the annunciator and keeps the circuit closed until the instrument is released and caused to reopen the circuit by means of a current of different condition, substantially as described.

28. A circuit-closing instrument in a normally open circuit, provided with polarized mechanism whereby when the instrument is set and the circuit closed it may be released so as to reopen the circuit by means of a current of one polarity sent through the circuit, in combination with an annunciator and bat-

tery of opposite polarity included in the said circuit, whereby the setting of the instrument operates the annunciator and keeps the circuit closed until the instrument is released
5 and caused to reopen the circuit by means of a current of the first polarity, substantially as described.

Signed and witnessed this 24th day of October, 1884.

F. BENEDICT HERZOG.

Witnesses:

CHARLES G. CURTIS,
FRANCIS B. CROCKER.