(No Model.)

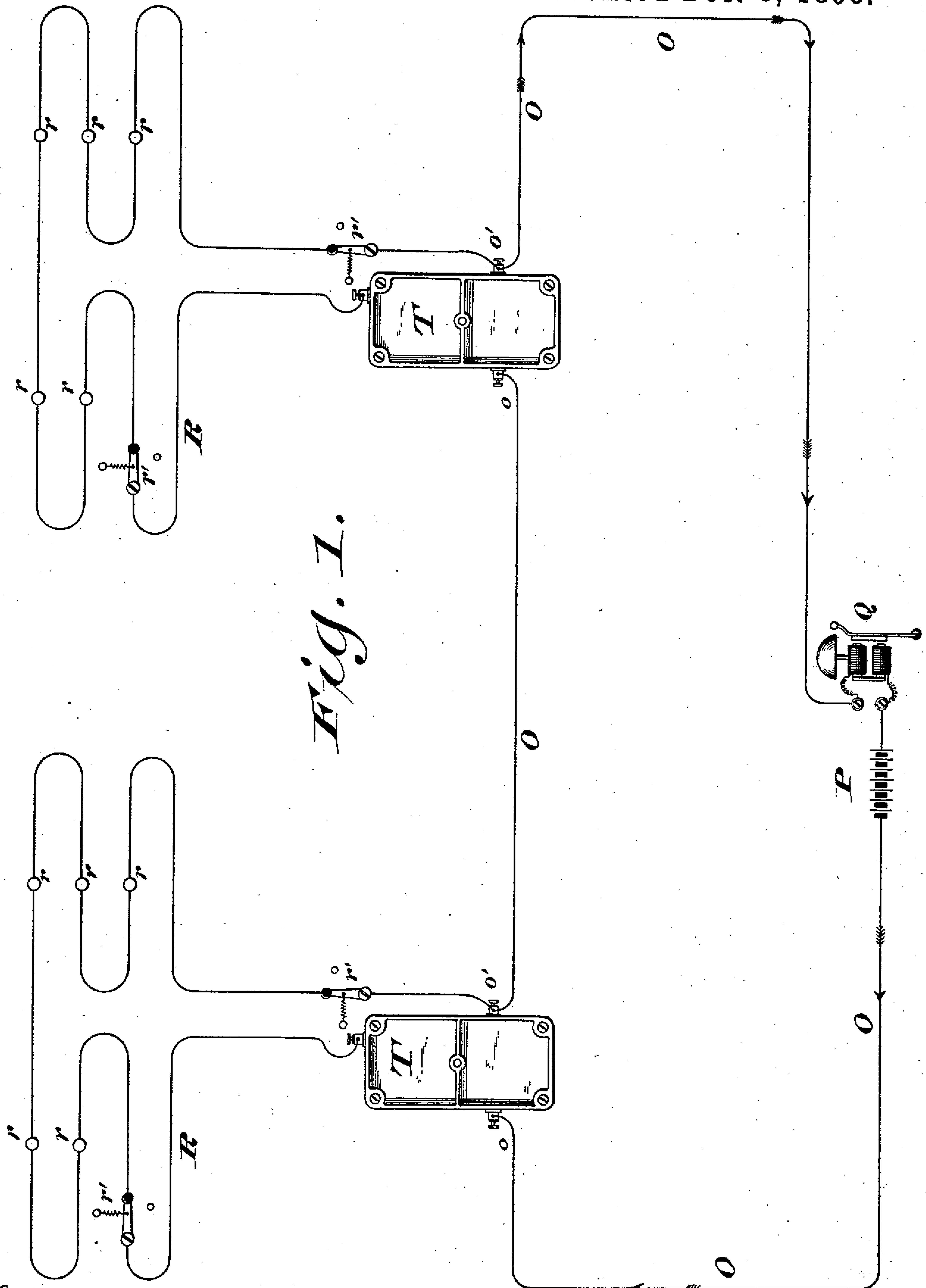
2 Sheets—Sheet 1.

G. KNOWLES.

ELECTRIC SIGNAL APPARATUS.

No. 572,607.

Patented Dec. 8, 1896.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

2 Sheets—Sheet 2.

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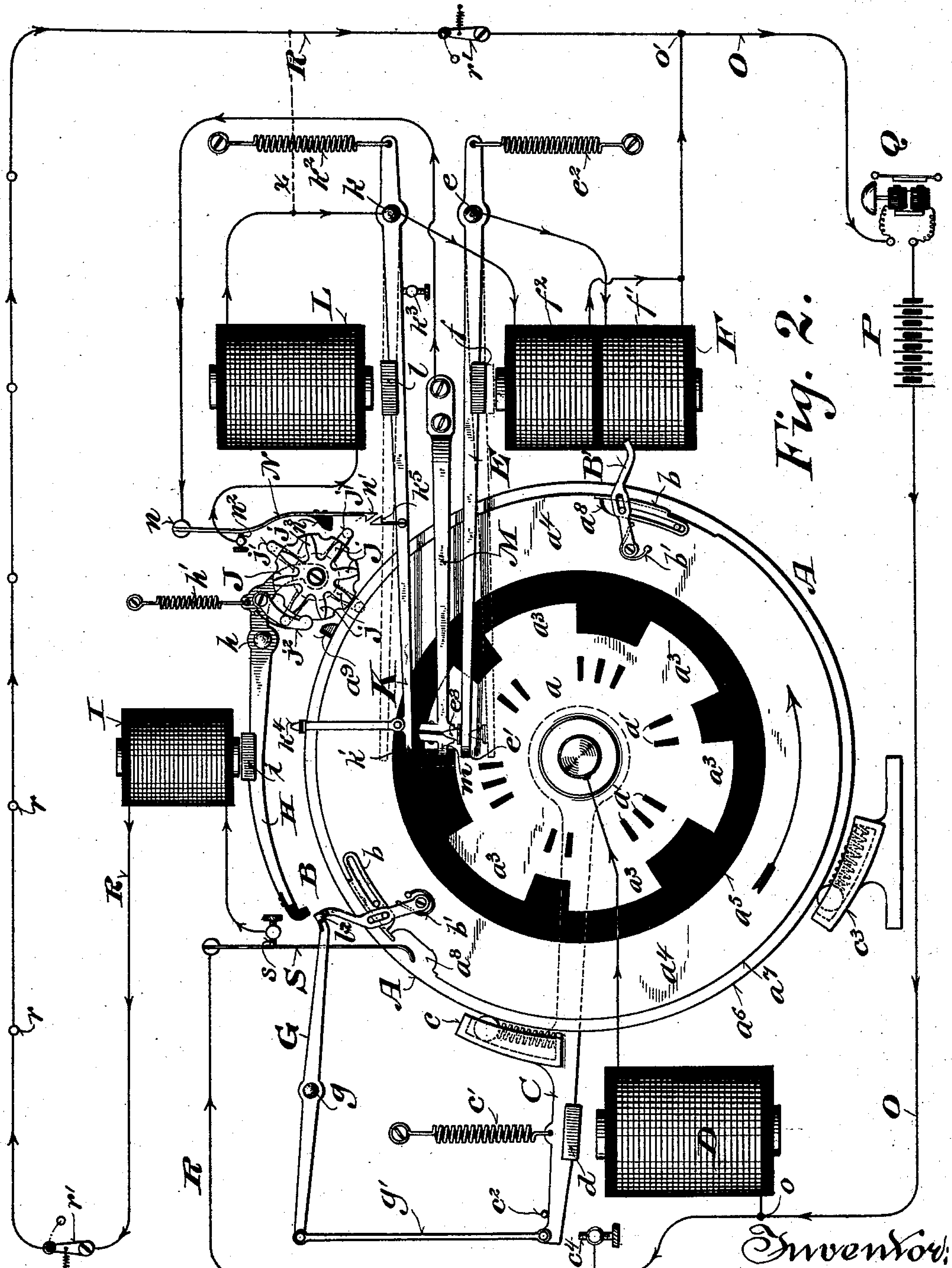

Fig. 2.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE KNOWLES, OF MILWAUKEE, WISCONSIN.

ELECTRIC SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 572,607, dated December 8, 1896.

Application filed July 19, 1895. Serial No. 556,497. (No model.)

To all whom it may concern:

Be it known that I, GEORGE KNOWLES, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Electric Signal Apparatus; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The main objects of my invention are to utilize the same electric circuit and generator for operating the signal-transmitting mechanism as are employed for the transmission of signals, to avoid confusion of signals in case two or more signal-transmitting devices are set in operation at or about the same time, to distinguish between intended and accidental breaks or interruptions of the circuit, to prevent the running down or stopping of the signal-transmitting devices in case of repeated interference, and to avoid the necessity of manually winding the transmitting mechanism.

In the accompanying drawings like letters designate the same parts in both figures.

Figure 1 is a diagram of apparatus embodying my invention including two signal-boxes, the main and branch circuits outside of said boxes, electric generator, receiving device, and circuit-controllers in the branch circuits; and Fig. 2 is an elevation of the mechanism inclosed in one of the signal-boxes, showing the associated branch circuits and the main circuit.

The embodiment of my invention in a complete system embraces generally a main electric circuit, a battery or electric generator, a suitable registering or signal-receiving device, and a number of signal-transmitting devices located at different points in the main circuit, as shown in Fig. 1.

Referring to Fig. 2 of the accompanying drawings, which shows in elevation the signal-transmitting mechanism of a single station and the electric circuits and included devices mainly in diagram, A designates a break or number wheel provided with a metallic or conducting contact-surface a, having insulating surfaces or spaces a' a', grouped and arranged therein so as to produce the desired signal, and projections a^3 a^3, corresponding with the spaces between the several number groups. It is also provided with a circular or annular conducting-surface a^4, and between it and the conducting-surface a with an insulating surface or space a^5, which is extended radially inward opposite the several number groups and between the outward conducting extensions a^3 a^3 of the conducting-surface a. It is formed or provided with a rim or flange a^6 and a rim or flange a^7, having breaks or notches a^8 a^8 therein. These breaks or notches are normally closed by slides or bridges b b, which are connected with the "home" and "trouble" stops B and B', pivoted to the break-wheel and turned and held normally forward by springs b' b'.

G is an arm or lever mounted to vibrate upon or concentrically with the axis of the break-wheel. It is provided with a friction-clutch or intermittent grip c, adapted to engage with a rim a^6 of the break-wheel and to turn the same intermittently in the direction indicated by the arrow thereon. It carries the armature d of an electromagnet D. A spring c' serves to retract said armature-lever from said magnet against a stop c^2, which arrests its movement within the magnetic field.

c^3 is a clutch or intermittent grip, like or similar to that on the armature-lever C, for preventing the backward movement of the break-wheel.

E is an arm or lever pivoted to a suitable support at e and provided at its opposite end with a contact e' in engagement with the conducting-surface a of the break-wheel. It carries the armature f of an electromagnet F and is retracted from said magnet by a spring e^2. This armature-lever E, with the conducting-surface a of the break-wheel, having the insulating-spaces a', serves for the transmission of a predetermined signal, the contact e' being drawn by the magnet F when it is energized into the path of said insulating-spaces and out of the path of said insulating-spaces by the retracting-spring e^2 when the magnet is deënergized.

G is a detent lever or arm pivoted at g to a suitable fixed base or support and connected

at one end by a rod g' with armature-lever C. It projects at its opposite end into the path of a laterally-projecting toe or offset b^2 of the home stop B of the break-wheel when the magnet D is deënergized and the armature-lever C is retracted by its spring c', but in any position clears the trouble stop B', which has no such toe or offset.

H is a hooked detent pivoted at h to the base of the instrument or other suitable fixed support and adapted to be turned at its hooked end into the path of both the home and trouble stops. It carries the armature i of an electromagnet I and is retracted from said magnet when it is deënergized into the path of said stops by a spring h'. It also carries a releasing-wheel J, having teeth j projecting, when the detent H is attracted by magnet I, into the path of a spur a^9 on the break-wheel, and teeth or projections j' for releasing a catch, hereinafter explained. The wheel J is moved intermittently, tooth by tooth, by the spur a^9 and is held in place by a spring-actuated pawl j^2, engaging shallow notches therein.

K is an arm or lever pivoted at k to the base of the instrument or any convenient support and provided with a contact k', normally resting upon or over the insulated surface or space a^5 of the break-wheel and movable therefrom into engagement with the conducting-surface a^4. It carries the armature l of an electromagnet L. A spring k^2 tends to carry said arm away from the magnet and holds it normally against a back-stop k^3. It is also provided with an insulated extension k^4, adapted to engage with the detent H and hold it in its attracted position when the arm K is held in its attracted position, as indicated by dotted lines.

M is a fixed arm provided with a contact-drag m in the path of the conducting extensions a^3 of the contact-surface a and insulated from said arm. The armature-lever E of the signal-transmitter is provided with a projection e^3, adapted, when it is retracted by spring e^2, to enter the space between and electrically connect the contact m with the arm M, which in this way serves as a back-stop for said lever E.

N is a spring strip or arm secured at one end to a fixed post n and provided at the opposite end with a hook n', adapted to engage with a similar hook k^5 on the armature-lever K and hold the latter in its attracted position. It presses normally against a contact-stop n^2 and is provided with an insulated projection n^3 in the path of the teeth j' of the releasing-wheel J, whereby at each second movement of said wheel said spring-strip will be forced out of engagement with the contact n^2 and the hook n' disengaged from the hook k^5 in case said hooks are engaged.

O designates the main electric circuit, which includes at convenient points therein a battery or generator P and a signal recording or receiving device Q. At each of the signal-transmitting stations the main circuit branches, as at $o\,o'$, one branch passing through the windings of the magnet D, thence through a conducting connection to the arbor of the break-wheel which is in electrical connection with its conducting-surfaces a and a^4, from the conducting-surface a through the armature-lever E, thence through the coil f' of the differentially-wound magnet F, back to the main line at o'.

A short circuit is made around the windings of magnet D through a contact-stop c^4, connected with the main line, the armature-lever C, and conducting-surfaces of the break-wheel. The armature-lever C, engaging this stop whenever it is attracted, short-circuits said magnet, which, together with the retracting-spring c', causes said lever to vibrate and thereby turn the break-wheel.

Another branch circuit R, passing through the windings of magnet I, is provided with one or more suitable circuit-controllers $r\,r$, designating thermostats, and $r'\,r'$ manual spring-retracted switches constructed and arranged to first break and then close the circuit. This branch also includes a circuit-controller comprising a contact-stop s and a spring-strip S normally bearing against said stop and projecting at its free end, which is insulated, into the path of the rim a^7 of the break-wheel. From the break-wheel a branch circuit passes by way of the armature-lever K through the coil f^2 of the differentially-wound magnet F to the main line at o'. Another branch passes by way of the arm M through the spring-strip N, contact n^2, windings of the magnet L, coil f^2 of the magnet F, thence to the main line.

The signal-transmitting and associated mechanism of each station is inclosed in a suitable case or box T, as shown in Fig. 1.

My improved apparatus operates as follows: Assuming that the parts of the signal-transmitting mechanism are at rest in the positions shown in the drawings, and that the branch circuit R, through which the current of the main line normally passes, is momentarily broken either by predetermined means, such as a thermostat r or switch r', or by accidental means, the current of the main line will be compelled to pass through the windings of magnet D, conducting-surface a of the break-wheel, armature-lever E, and winding f' of magnet F. Magnet D being thus energized will attract its armature and through its connection with lever G release the home stop B and at the same time turn the break-wheel A forward intermittently by the vibration of the lever C, as hereinbefore explained. Magnet F being at the same time energized by its coil f' attracts its armature and draws the contact e into the path of the insulating surfaces or spaces a' of the break-wheel. As soon as said contact rides upon or over the first insulating surface or space a' of the first number group, the circuit will be broken through the coil f' of magnet F and also through the main line.

This break will be registered or indicated by the receiving device Q at headquarters. The magnet F being deënergized by the breaking of the circuit releases its armature, permitting the lever E to be retracted by the spring e^2, which carries the contact e' into engagement with the conducting-surface a, whereupon the circuit will be instantly closed through the path or signal-transmitting branch last mentioned and the contact e' drawn into the path of the next insulating surface or space a'. The contact e' in passing the several insulating surfaces or spaces of the first number group makes what is commonly called "one round of the box" and produces at headquarters a signal designating the box or station number, which, if not repeated, indicates an accidental break or interruption of the branch circuit R and constitutes what is known as a "trouble alarm." After the first number group has passed said contact the trouble stop B' of the break-wheel is caught by the detent H and withdraws slide b from notch a^8. The spring-strip S thereupon drops into said notch and makes contact with stop s, closing branch circuit R at that point. In case the other break in said branch circuit is not closed, as by the normal operation of a thermostat r or switch r', the break-wheel will be held by the engagement of said detent with the trouble stop from turning farther, and but one round of the box, indicating "trouble" or an accidental break or interruption of the circuit, will be turned in. On the other hand, if said branch circuit is immediately closed by a thermostat or switch after being broken, the detent H will be drawn by magnet I out of engagement with the trouble stop B' as soon as the spring-strip S drops into the adjacent notch a^8 and engages stop s, and the associated slide b being thus released will be thrown forward by spring b' over said notch, thereby forcing spring-strip S out of contact with stop s and breaking the branch circuit R at that point. The break-wheel will thus be allowed to complete its revolution and turn in "several rounds of the box," giving the full predetermined signal or alarm, consisting of the box number repeated one or more times at headquarters. The break-wheel (shown in Fig. 2 of the drawings) having three number groups would at each revolution repeat the box number twice at headquarters for a full alarm. Upon the completion of a revolution by the break-wheel the home stop B will be caught by the detent H, the adjacent notch a^8 opened by the withdrawal of the bridge-piece b, and the spring-strip S will drop into said notch, thereby closing the branch circuit at s, energizing magnet I, and causing it to withdraw the detent H from engagement with the home stop, which is thus permitted to spring forward into engagement with the stop arm or lever G, as shown in the drawings.

While the number groups a' of the break-wheel are passing the contact e', the contact m is passing over the insulated surfaces or spaces between the conducting extensions a^3 a^3. Thus no current can pass through the arm M to energize magnet L. If now during the transmission of a signal another box should be set in operation and the main circuit broken while the contact e' was "spacing," that is, passing between two adjacent number groups of insulating surfaces or spaces a' in contact with the conducting-surface a, magnet F would be deënergized precisely as in the case of the breaking of the signal-transmitting branch by one of the insulating surfaces or spaces a', and the armature-lever E would be retracted by spring e^2, carrying the contact e' out of the path of the insulating-spaces a' and the projection e^3 into engagement with arm M and its insulated contact m. In this position of the break-wheel, the contact m being in contact with one of the conducting extensions a^3, circuit will be made through the arm M, magnet L, and coil f^2 of magnet F. Magnet L, being thus energized, attracts its armature, and the lever K, carrying the contact k' into engagement with the conducting-surface a^4 of the break-wheel and the hook k^5 into engagement with the hook n'. The lever K will thus be held in its attracted position and the current of the main circuit will divide, a part through arm K and coil f^2 of magnet F. Magnet F, being differentially wound, is thus deënergized and its armature and lever E retained in their retracted position by spring e^2, thereby holding the contact e' out of the path of the insulating surfaces or spaces a' of the break-wheel. The signal-transmitting mechanism is thus rendered inoperative and the circuit is maintained unbroken for the transmission of a signal by the interfering box, the box last breaking the circuit taking precedence and retaining control of the main circuit until it has sent in its complete signal. When the armature-lever K is attracted, its extension k^4, engaging with detent H, carries or holds it out of range with the stops B and B' of the break-wheel, preventing the closing of the branch circuit R at s. At the same time the teeth j of the releasing-wheel J are moved into or held in the path of the spur a^9. In this position of the mechanism the spur a^9 must pass the releasing-wheel J twice before the associated transmitting mechanism will be restored to condition for transmitting its signal. Upon the second movement of the releasing-wheel J one of its spurs or teeth j' will engage the projection n^3 of the spring-strip N, forcing it out of engagement with the contact n^2 and with the hook k^5, thereby breaking the branch circuit, including magnet L, and releasing the armature-lever K, which will be retracted by the spring k^2, carrying the contact k' over the insulating surface or space a^5. Magnet F, whose coil f^2 is thus deprived of current, will be energized by its coil f' and attract its armature and the lever E, carrying the contact e' back into the path of the insulating-spaces a' of

the break-wheel. The break-wheel will now make a complete revolution, and unless interfered with will transmit its complete signal to headquarters the same as when it is set in operation by the breaking and immediate closing of the branch circuit R.

It will be observed that in whatever position of the break-wheel another box cuts in the releasing-wheel J allows the other box sufficient time to send in a complete signal before the signal-transmitting branch of the associated box is restored, after which the associated break-wheel makes a complete revolution, sending in its complete signal.

If a number of boxes are set in operation at or about the same time, that which breaks the main circuit last will take precedence and control the main line until it has transmitted its complete signal, and the break-wheels of the other boxes whose operation has been interrupted will continue to rotate until each has transmitted its complete signal uninterrupted or so long as the main circuit is supplied with current.

For the purpose of distinction, the magnet D may be called the "actuating-magnet," magnet F the "signal-magnet," the magnet I the "releasing-magnet," and the magnet L the "non-interference magnet." To prevent the non-interference magnet L from acting in advance of the signal-magnet F when the break-wheel is started from the position in which it is shown in the drawings, the inwardly-projecting portion of the insulating surface or space a^5 opposite the last number group is extended so that the contact m will rest upon or over said surface or space when the break-wheel is at rest in its home position.

I do not wish to be understood as limiting myself to the exact details of construction shown and described, as they may be variously modified within the spirit and intended scope of my invention. For instance, the conducting and insulating surfaces or spaces of the break-wheel for the transmission of signals and the control of the branch circuit for rendering the signal-transmitting mechanism inoperative may be arranged on the periphery or cylindrical surface of the break-wheel or may be placed on different wheels, and in place of the differentially-wound magnet F a plain-wound magnet may be substituted by connecting the armature-lever K and the windings of magnet L directly with the branch circuit R or main circuit O, as by a wire x.

By the term "number groups" as employed herein I mean to include not only insulating surfaces or spaces, as shown, but also teeth or notches or any other provision in connection with a break-wheel for breaking the circuit and repeating the box or station number one or more times.

I claim—

1. In electric alarm or signal apparatus, the combination with a main circuit, including a receiving and a number of transmitting devices adapted to indicate the source of the alarms or signals, of means associated with each transmitting device for rendering it inoperative when interrupted by another and thereby preventing interference or confusion of signals, such means comprising a branch circuit around each transmitting device, and a branch-circuit controller consisting of a rotary contact connected with the main circuit and movable synchronously with the associated signal-transmitting device, a movable contact in the branch circuit adapted to engage with said rotary contact, and means for automatically shifting said movable contact to close said branch circuit whenever the main circuit is broken while the associated signal-transmitting device is "spacing," substantially as and for the purposes set forth.

2. In electric alarm or signal apparatus, the combination with a main circuit, including a receiving and a number of transmitting devices adapted to indicate the source of alarms or signals, of means associated with each transmitting device for rendering it inoperative when interrupted by another, and thereby preventing interference and confusion of signals, such means comprising a branch circuit, a branch-circuit controller consisting of a contact-wheel, an armature-lever in the branch circuit adapted to engage with said contact-wheel, a magnet for operating said lever to open or close said branch circuit, and a detent for holding said lever in position to maintain said branch circuit closed during interference, substantially as and for the purposes set forth.

3. In electric alarm or signal apparatus, the combination with a main circuit, including a receiving and a number of signal-transmitting devices adapted to indicate the source of signals transmitted thereby, of means associated with each transmitting device for rendering it inoperative when interrupted by another and thereby preventing interference and confusion of signals, such means comprising a branch circuit, a continuous rotary conducting-contact connected with the main circuit, an armature-lever in the branch circuit adapted to engage with said rotary contact, a magnet arranged to actuate said lever for opening or closing the branch circuit, a catch or detent for holding said lever in position to maintain the branch circuit closed, and means for automatically releasing said catch or detent, substantially as and for the purposes set forth.

4. In an electric alarm or signal apparatus, the combination with a main circuit, including a receiving and a number of signal-transmitting devices adapted to indicate the source of signals, of means associated with each transmitting device for rendering it inoperative whenever it is interrupted by another and thereby preventing interference and confusion of signals, such means comprising a branch circuit, a continuous rotary conduct-

ing-contact connected with the main circuit, an armature-lever connected with the branch circuit and movable into and out of engagement with said rotary contact, a magnet arranged to actuate said lever, and a circuit-controller consisting of a series of contacts in connection with the main circuit corresponding in number and arrangement with the spaces between the number groups of the associated transmitting device, and movable synchronously therewith, a contact-drag in the path of the said movable series of contacts and in a branch circuit with said magnet, and a device arranged to close a break in said branch circuit whenever a break occurs in the main circuit while said drag is in engagement with any of said series of movable contacts, substantially as and for the purposes set forth.

5. In an electric alarm or signal system, the combination with an electric circuit including receiving apparatus, of transmitting mechanism consisting of a break or number wheel having a continuous conducting-surface connected with and included in said circuit, and a series of insulating-spaces arranged to produce the desired signal, an armature-lever provided with an electrical contact also connected with said circuit and movable in engagement with said conducting-surface into and out of the path of said insulating-spaces, and an electromagnet in said circuit for actuating said lever, substantially as and for the purposes set forth.

6. In an electric alarm or signal system, the combination with an electric circuit, including receiving apparatus, of transmitting mechanism comprising a break or number wheel having a conducting-contact-surface connected with and included in said circuit and insulating-spaces arranged and grouped to produce a given signal, an armature-lever provided with an electrical contact connected with said circuit and movable in engagement with said conducting-surface into and out of range with said insulating-spaces, a magnet for actuating said lever and a magnet for actuating said break or number wheel, both included in said circuit, substantially as and for the purposes set forth.

7. In automatic electric signaling apparatus, the combination with an electric circuit including receiving apparatus, of transmitting mechanism comprising a break or number wheel having a conducting contact-surface in said circuit, and insulating-spaces grouped to produce a given signal, a contact connected with said circuit and movable into and out of the path of said insulating-spaces, a magnet for actuating said contact, a vibrating arm for turning said number-wheel, a magnet connected with the main circuit for actuating said arm, a short circuit around said magnet through the conducting-contact of the number-wheel, and a circuit-controller operated by said vibrating arm for alternately opening and closing said short circuit, substantially as and for the purposes set forth.

8. In an automatic electric signal-transmitting system, the combination with an electric circuit, including receiving apparatus, of a break or number wheel provided with home and trouble stops, a catch or detent movable into and out of the path of said stops, a branch circuit provided with one or more circuit-controllers, a magnet in said branch circuit for operating said detent, a circuit-controller in said branch circuit comprising a spring-strip or movable arm and a contact, a rim or flange movable with said break-wheel and adapted to press and hold said spring-strip or arm out of engagement with the opposing contact, and spring-actuated bridge-pieces connected with said stops and adapted when released to close notches or breaks in said rim or flange, substantially as and for the purposes set forth.

9. In an automatic electric signal-transmitting system, the combination with an electric circuit including receiving apparatus, of a break or number wheel provided with home and trouble stops movably connected therewith, a detent or catch movable into and out of the path of the home stop, a magnet arranged to actuate said detent, a branch circuit governing the operation of said magnet and provided with one or more circuit-controllers, a catch movable into and out of the path of both home and trouble stops, a magnet in said branch circuit for actuating said catch, a circuit-controller in said branch circuit comprising a spring-strip or movable arm, and an opposing contact, a rim or flange movable with said break-wheel and adapted to press and hold said spring-strip out of engagement with the opposing contact, and spring-actuated bridge-pieces connected with said stops and adapted when released to close breaks in said rim or flange, substantially as and for the purposes set forth.

10. In automatic electric signal apparatus, the combination with a main circuit, including suitable receiving mechanism, of signal-transmitting mechanism consisting of a break-wheel provided with a continuous conducting-surface connected with the main circuit and provided with insulating-spaces grouped to produce the desired signals, an armature-lever also connected with the main circuit and having a contact movable in engagement with the conducting-surface of the break-wheel into and out of the path of its insulating-spaces, and a magnet in the main circuit for actuating said lever; and mechanism for rendering said signal-transmitting mechanism inoperative during interference and for maintaining circuit for the transmitting devices, comprising a branch circuit adapted when closed to deënergize the signal-magnet, a branch-circuit controller consisting of a continuous conducting-surface movable synchronously with the break-wheel

and connected with the main circuit, of an armature-lever movable into and out of contact therewith, and of a magnet for actuating said lever; and an arm or conductor connected with said magnet and provided with a contact insulated therefrom, and located in the path of conducting-surfaces of the break-wheel corresponding in number and position with the spaces between its number groups, the signal armature-lever being constructed and arranged when retracted from the path of the insulating-spaces of the break-wheel to electrically connect said insulated contact with said arm, substantially as and for the purposes set forth.

11. In electric signal apparatus the combination with a main circuit, including receiving mechanism, a break-wheel and contact with which the break-wheel coöperates to transmit signals through said circuit, of means for preventing confusion of signals in the event of interference, comprising a branch circuit adapted when closed to render the signal-transmitting mechanism inoperative and to maintain the circuit for the transmission of signals by other instruments, a circuit-controller for opening and closing said branch circuit, a magnet for operating said circuit-controller to close the branch circuit when interference takes place, a catch for holding said circuit-controller closed, and a releasing-wheel independent of and operated by the break-wheel to disengage said catch after interference ceases and the interfering instrument has transmitted its complete signal, substantially as and for the purposes set forth.

12. In electric signal apparatus, the combination with a main circuit, a break-wheel for transmitting signals, of means for rendering the break-wheel inoperative, comprising a branch circuit, a detent arranged to engage and stop said break-wheel, a magnet for disengaging said detent, a circuit-controller arranged to close the branch circuit when interference occurs, a catch for holding said circuit closed, and a releasing-wheel carried by said detent and operated by the break-wheel to release said catch at the proper time to permit at least one revolution of the break-wheel after interference ceases, substantially as and for the purposes set forth.

13. In electric signal apparatus the combination with a main circuit, including receiving mechanism, a break-wheel for transmitting signals, and means including a branch circuit for rendering the break-wheel inoperative during interference, a movable detent for arresting and holding the break-wheel, a magnet for disengaging said detent, a movable contact lever or arm controlling the branch circuit and having an extension adapted to hold said detent out of engagement with the break-wheel when the branch circuit is closed, a magnet arranged to shift said contact-lever and close the branch circuit through its contact when interference occurs, a catch for holding said lever in its abnormal or closed position, and a releasing-wheel carried by said detent independent of and operated by the break-wheel to release said catch at the proper time to allow a complete signal to be transmitted by the break-wheel after interference ceases, substantially as and for the purposes set forth.

14. In electric signal apparatus, the combination with a main circuit, including a receiving instrument, of a break-wheel provided with a contact-surface connected with said circuit and having insulating-spaces grouped to produce the desired signal, an armature-lever having a contact also connected with said circuit and movable into and out of the path of said insulating-spaces, a branch circuit, a magnet arranged to close said branch circuit when interference occurs, and a differentially-wound magnet arranged to actuate said armature-lever, and having one winding in the main circuit and the other in the branch circuit, substantially as and for the purposes set forth.

15. In non-interfering electric signal apparatus, the combination with a main circuit, including receiving mechanism, of a transmitting device, comprising a break-wheel having a series of number groups, a circuit-controller comprising a wheel provided with a series of conducting-surfaces electrically connected with the main circuit and separated from each other by insulating surfaces or spaces corresponding in number and arrangement with the number groups of the signal-transmitting device, a branch circuit having a break and including a contact in the path of said conducting-surfaces, and a movable part arranged to automatically close said break in the branch circuit whenever another transmitting device breaks the main circuit while the first-mentioned transmitting device is spacing, substantially as and for the purposes set forth.

16. In non-interfering electric signal apparatus comprising a main circuit, including a receiving device and a number of transmitting devices, means comprising a branch circuit and circuit-closer associated with each transmitting device for rendering it inoperative in case of interference, and a releasing-wheel independent of and actuated by the associated transmitting device to open said branch circuit and render said transmitting device operative when the interfering transmitting device has completed its signal, substantially as and for the purposes set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

GEORGE KNOWLES.

Witnesses:
CHAS. L. GOSS,
FRANK A. KREHLA.