

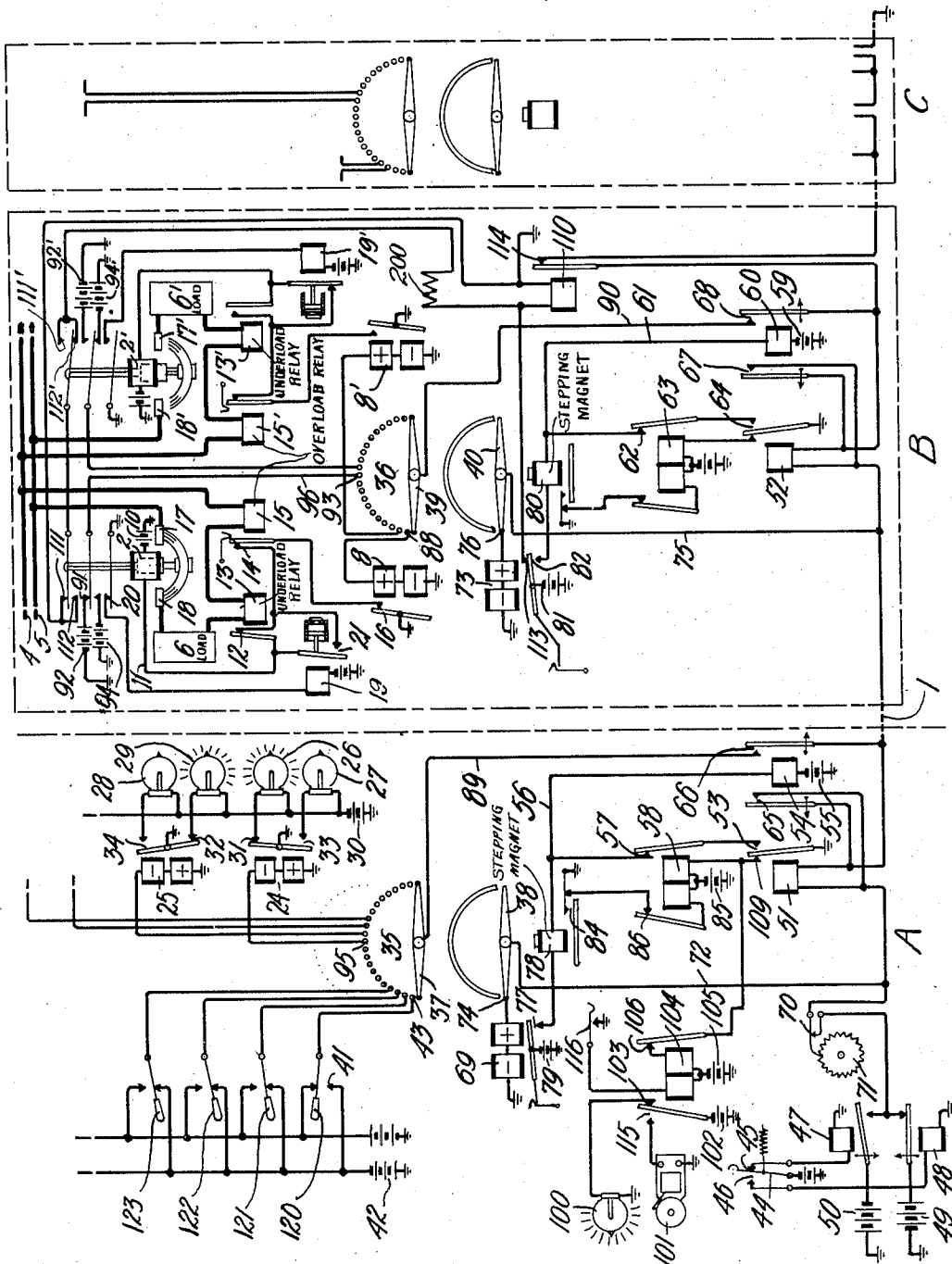
June 14, 1927.

1,632,106

F. ZOGBAUM

SIGNALING SYSTEM

Filed Nov. 24, 1923



Inventor:
Ferdinand Zogbaum
by Edward A. Affy

UNITED STATES PATENT OFFICE.

FERDINAND ZOGBAUM, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

SIGNALING SYSTEM.

Application filed November 24, 1923. Serial No. 676,843.

This invention relates to signaling systems and particularly to signaling systems for use in connection with the remote control and supervision of power switches and the like.

It is an object of the invention to provide an improved signaling system, whereby switches or other devices may be remotely controlled and supervised.

The invention provides a central or controlling station and a plurality of remote stations joined by a normally closed line conductor. Distributors are provided at the central station and each of the remote stations, and are adapted to be operated in synchronism when set in motion by mechanisms controlled at the central station. A plurality of power switches are provided at each of the remote stations and are adapted to be operated by individual control keys at the central station through the medium of the synchronously operated distributors. Certain of the contacts on the distributors at the remote stations are connected to auxiliary contacts on the power switches and are included in circuits adapted for the transmission of answer-back signals to the central station upon the operation of the respective power switches.

In accordance with a feature of the invention, the distributor actuating mechanisms are normally disconnected from the line circuit and are adapted to be simultaneously associated therewith preparatory to the transmission of the distributor controlling impulses.

According to another feature of the invention, means is provided for operating the distributors in accordance with controlling impulses transmitted from the central station whereby the distributors, instead of being operated by a definite predetermined order or number of impulses, are operated by such of the impulses as are determined by the distributor controlling mechanisms. More specifically, after the distributor actuating mechanisms have been associated with the line circuit and the impulse transmitting device has been set in operation, the first impulse transmitted will operate the distributor actuating mechanisms to advance the distributors one step, and each succeeding impulse transmitted over the line will advance the distributors only if the distributor actuating mechanisms have had time to

return to their normal positions, but if they have not returned to their normal positions the intervening impulses will have no effect.

Another feature of the invention relates to the means provided for operating a distinctive answer-back signal at the central station to notify the attendant whenever a power switch operates, due to abnormal conditions such as overload or underload, when the system is at rest.

According to another feature of the invention, means is provided for locking out such distinctive answer-back signals during the transmission of controlling impulses.

Other features and advantages of the invention will appear from the following description and the annexed drawing which illustrates diagrammatically one embodiment of the invention.

Referring to the drawing, a central station A and a plurality of remote stations B and C are connected by means of a common line conductor 1. A plurality of power switches 2 and 2' are located at each of the remote stations, but, for the sake of clearness, only the power switches at the station B are shown. These switches are adapted to control the application of current from a power line comprising conductors 4 and 5 to loads 6 and 6', respectively, according to whether the power switches are opened or closed. The power switches 2 and 2' are adapted to be controlled from the central station A and are also adapted to be operated automatically by local means responsive to abnormal conditions on the power line. The power switch 2 is controlled by means of a polarized relay 8 and the power switch 2' is controlled by means of a polarized relay 8', these relays being operated from the central station A in a manner hereinafter to be described. Under the conditions shown in the drawing, the power switch 2 is energized over a circuit extending from grounded battery 10, through winding of power switch 2, conductor 11, contact 12 of underload relay 13, contact 14 of overload relay 15, contact 16 and armature of polarized relay 8 to ground. The power switch 2 thus being closed, current is supplied to the load 6 over a circuit extending from conductor 5 of the power line, through contacts 17 and 18 of the power switch, load 6, winding of underload relay 13 winding of overload

relay 15 to conductor 4 of the power line. If now, the polarized relay 8 is energized by current of negative polarity, it will be evident that the circuit of the power switch will be broken at the contact 16 and that the power switch will be deenergized and open the energizing circuit of the load 6 at the contacts 17 and 18. Furthermore, even if the polarized relay 8 is maintained in the closed position shown in the drawing nevertheless the power switch 2 will be deenergized upon the occurrence of an overload or underload on the power line. For example, if the current on the power line should fall below the minimum required to maintain the underload relay 13 operated, the armature of this relay will fall back and open the energizing circuit of the power switch 2 at the contact 12. As soon as the power switch 2 is opened an auxiliary contact 20 controlled thereby is also opened, thus deenergizing a slow releasing or "time operated" relay 19. The time required for the relay 19 to become fully deenergized may be adjusted in accordance with the nature of the load 6. If the load 6 be an ordinary lighting circuit the relay 19 may be adjusted to close its contact 21 in 10 or 20 seconds to again operate the power switch 2 in order that the lighting circuit comprising the load may not be cut-off from the power line for too long a time, but if the load 6 be in the nature of motors employed to run mills or factories, the relay 19 would preferably be so adjusted as to require thirty seconds to one and one-half minutes for closing the contact 21 in order that all such motors might attain a state of rest before again being connected to the power line. As soon as the relay 19 in deenergizing closes its contact 21, an energizing circuit for the power switch 2 is completed from grounded battery 10, through winding of power switch 2, conductor 11, armature and contact 21 of relay 19, contact 14 of overload 15, contact 16 and armature of polarized relay 8 to ground, thus again closing the power switch. If, however, the abnormal condition referred to still exists on the power line, the power switch will be again deenergized in the manner described and a minute or two later, depending upon the adjustment of relay 19, will again be energized, which opening and closing of the power switch transmits a distinctive signal to the central station A in a manner hereinafter to be described. The attendant at the central station, observing that the power switch 2 is being opened and closed, may operate the polarized relay 8 at station B thereby opening the energized circuit of the power switch 2 at the contact 16 and preventing the further opening and closing of the power switch until the trouble on the power line is repaired. If a sudden surge of current is impressed upon the power line the

power switch 2 will be opened due to the opening of the contact 14 of overload relay 15 which may be designed to operate upon any predetermined excess current. Overload relay 15 is the mechanical locking type and when it operates, its armature is held in the operated position with contact 14 open. When the overload condition is removed, contact 14 is made manually. The power switch 2' is provided with controlling elements identical with those described in connection with power switch 2, similar elements bearing the same reference numerals with primes affixed thereto. Summarizing, the above, the power switches at the remote stations are adapted to be operated selectively by means controlled at the central station A and are also adapted to be controlled automatically by local apparatus individual to each power switch upon the occurrence of an overload or underload on the power line; and furthermore, when any power switch is operated a circuit will be completed for transmitting an answer-back signal to the central station and, if the system be at rest when such operation takes place, an additional distinctive signal will be transmitted to the central station as hereinafter described.

The power switches 2 and 2' at station B are controlled from the central station A by means of control switches 120 and 121, respectively, while additional control switches 122 and 123 are allotted to the control of similar switches at station C. Upon the operation of any power switch an answer-back circuit is prepared for operating a signal controlling relay at the central station of which polarized relays 24 and 25, allotted respectively to power switches 2 and 2', are typical. Polarized relay 24 controls a pair of lamps 26 and 27 for indicating the position of the power switch 2, while polarized relay 25 controls a pair of lamps 28 and 29 for indicating the position of power switch 2'. One or the other of each of these pairs of lamps is normally lighted, current being supplied thereto from a grounded battery 30, through contacts controlled by the armatures of relays 24 and 25. In the position shown in the drawing, the lamp 26 is lighted over a circuit extending from grounded battery 30, through filament of lamp 26, contact 31 and armature of relay 24 to ground; while the lamp 29 is lighted over a circuit extending from grounded battery 30, through filament of lamp 29, contact 32 and armature of polarized relay 25 to ground. Upon the operation of the polarized relay 24 by current of negative polarity, however, the lamp 26 is extinguished and lamp 27 is lighted over a circuit extending from grounded battery 30, through filament of lamp 27, contact 33 and armature of polarized relay 24 to ground; while upon the operation of

polarized relay 25 by current of positive polarity the lamp 29 is extinguished and lamp 28 is lighted over a circuit extending from grounded battery 30, through filament of lamp 28, contact 34 and armature of polarized relay 25 to ground.

The power switch controlling relays 8 and 8' at the remote stations and the signal controlling relays 24 and 25 at the central station are controlled through the medium of synchronously operated distributor switches 35 and 36 which are preferably of the type disclosed in Patent No. 1,472,465 to O. F. Forsberg and R. M. De Vignier, dated October 30, 1923. These distributors are each provided with two brush arms, the distributor 35 being provided with arms 37 and 38 and the distributor 36 with arms 39 and 40, similar elements being provided at station C. The contact arm 37 of distributor 35 is adapted for selective engagement with an arcuate row of contacts, half of which are allotted to the control keys 120, 121, etc., and the other half of which are allotted to the signal controlling relays such as 24 and 25. At the remote station B and all other similar remote stations, such as station C, the brush arm 39 of distributor 36 is adapted for selective engagement with an arcuate row of contacts, one half of which are allotted to power switch controlling relays, such as 8 and 8' and the other half of which are connected to auxiliary contacts on the various power switches for the purpose of transmitting an answer-back signal to the central station upon the operation of the power switches. At all of the stations, the lower contact bank of the distributors contains a single contact which is normally engaged by the lower brush arm, such as arm 38 or 40, but which is opened when the distributor takes its first step, and is subsequently closed when the distributor has made one complete revolution to stop the rotation of the brush arm.

The apparatus of the system is normally at rest and functions only when the power switches are operated from the central station or when automatic operation is taking place at the various remote stations. If the despatcher at the central station A wishes to operate a particular power switch at one of the remote stations, he operates the appropriate control key at the central station and then starts the distributor controlling mechanisms which cause all of the selectors to step up and search out each one of their respective contacts. When the distributors at the central station and a given substation reach the contacts which are allotted, respectively, to the operated control key and the power switch to be operated, a circuit will be completed which includes the common line conductor 1 for operating the desired power switch, and subsequently upon the

further advancement of the distributors, an answer-back circuit will be completed through the medium of these same distributors for controlling the appropriate lamps at the central station.

The above features together with other important features of the invention will appear more clearly from the following description of the operation of the system: As pointed out above, when the attendant at the central station A desires to open or close any power switch at any of the remote stations, he operates the appropriate control key and then starts the distributor controlling mechanisms, causing the distributor at the central station as well as the distributors at all the remote stations to step up and search out each of their respective contacts. If, for example, it is desired to open the power switch 2 at station B, the control switch 120 is moved into engagement with its lower contact 41, thus connecting current of negative polarity from grounded battery 42 to the contact 43 of distributor 35. A key 44, which is preferably of the two-position type, biased to make contact at 45 when arm 44 is unrestrained is then moved, opening the contact 45 and closing the contact 46. This operation of key 44 deenergizes a slow releasing relay 47 and energizes a slow releasing relay 48, over obvious circuits, causing relay 48 to attract its armature and disconnect the source of current of positive polarity 49 from the line circuit and allowing the armature of slow releasing relay 47 to fall back and connect current of negative polarity from battery 50 to the line conductor 1. During the interval between the opening of the line by the relay 48 and the subsequent closing of the line by the release of the armature of relay 47, line relays 51 and 52 at the central and remote stations respectively are deenergized. The armature of relay 51 in falling back closes contact 53 thus completing an energizing circuit for a slow releasing relay 54 which extends from grounded battery 55, through winding of relay 54, conductor 56, contact 57 and armature of a two winding relay 58, contact 53 and armature of line relay 51, to ground. A similar circuit is completed at the station B, as well as all other remote stations, which may be traced from grounded battery 59, through winding of slow releasing relay 60, conductor 61, contact 62 and armature of relay 63, contact 64 and armature of line relay 52 to ground. The energization of slow releasing relay 54 closes its contact 65, thus short circuiting the line relay 51 out of the line 1, and also closes a contact 66 thereby associating the brush arm 37 of the selector 35 with the line 1 for signaling purposes, as will hereinafter appear. Similarly, the operation of slow releasing relay 60 short circuits the line relay 52 through contact 67

and also closes a contact 68 adapted for signaling purposes. As soon as the slow releasing relay 47 at the central station A has permitted its armature to fall back to connect current of negative polarity to the line 1, as described above, a polarized relay 69 at the central station is thereupon energized with current of negative polarity over a circuit extending from grounded battery 50, through armature and contact of relay 47, contact 70 of impulse wheel 71, conductor 72, brush arm 38 and contact 74 of distributor 35, windings of polarized relay 69 to ground. Relay 69 is the two-position type locking in the position to which it is last operated. A similar polarized relay 73 at the remote station B is also energized with current of negative polarity over a circuit extending from grounded battery 50, through armature and contact of relay 47, contact 70 of impulse wheel 71, contact 65 of slow releasing relay 54, line conductor 1, conductor 75, brush arm 40 and contact 76, of distributor 36, windings of polarized relay 73 to ground. The operation of the polarized relay 69 by current of negative polarity closes contact 77 thus energizing the stepping magnet 78 of the distributor 35 over a circuit extending from grounded battery 79, through armature and contact 77 of polarized relay 69, winding of stepping magnet 78, contact 57 and armature of relay 58, contact 53 and armature of line relay 51 to ground. Similarly, the operation of the polarized relay 73 at the remote station B by current of negative polarity completes an energizing circuit for the stepping magnet 80 of the distributor 36 which extends from grounded battery 81, through armature and contact 82 of polarized relay 73, winding of stepping magnet 80, contact 62 and armature of relay 63, contact 64 and armature of relay 52 to ground. The stepping magnet 78 of distributor 35 in energizing attracts its armature thus opening the contact 84 which is in the energizing circuit of relay 58. The relay 58 in deenergizing opens contacts 57 and 86, the former of which is in the energizing circuits of magnet 78 and slow releasing relay 54. The magnet 78 thus being deenergized allows its armature to fall back, advancing the distributor 35 one step, and also permitting the closing of contact 84. The slow releasing relay 54 in opening its contact 65 removes the short circuit from the line relay 51. A similar operation takes place at station B and all other remote stations.

The key 44 at central station A may now be released, opening contact 46 and closing contact 45, but since the relays 47 and 48 are of the slow releasing type there will be a short time interval between the applications of negative and positive currents to the line conductor 1, in order that the dis-

tributors at the various stations may have time enough to take one step ahead. The distributors at all stations have now taken one step ahead. The impulse wheel 71, which is provided with a plurality of teeth in excess of the number of contacts on the upper row of the distributors is now rotated to open and close the line conductor 1 periodically at the contact 70. This impulse wheel is arranged to make one revolution and stop and is of the type disclosed in Patent 1,354,814 to J. C. Field dated October 5, 1920, but any similar type of impulse wheel may be used. The periodic opening and closing of the line conductor 1 alternately deenergizes and energizes line relays 51 and 52. The deenergization of line relay 51 closes its contact 53 thus completing energizing circuits for the stepping magnet 78 and the slow releasing relay 54 as described above. The stepping magnet 78 in attracting its armature opens the contact 84, as described above, thus deenergizing relay 58 which was previously energized over a circuit extending from grounded battery 85, through winding of relay 58, armature and contact 86 of relay 58, contact 84 of stepping magnet 78 to ground. The deenergization of relay 58 opens the energizing circuit of the motor magnet 78 and also the energizing circuit of the slow releasing relay 54 at the contact 57, thus causing the armature of stepping magnet 78 to fall back and give the distributor 35 its next step forward. The deenergization of relay 58 also further opens its own energizing circuit at the contact 86. The slow releasing relay 54 in deenergizing opens its contacts 65 and 66, thus again connecting the line relay 51 to the line conductor 1 where it will again be deenergized by the next opening of the line circuit. However, since the relay 54 is of the slow releasing type it will not release its armatures until the selectors have had sufficient time to advance one step. When the contact 65 of the relay 54 is opened the line relay 51 will again be energized thus completing an energizing circuit for the relay 58 which extends from grounded battery 85, through winding of relay 58, contact 109 and armature of relay 51 to ground. The distributor actuating mechanisms will thus be returned to their normal positions at the completion of each advance of the distributors. Since the distributor 36 is stepped forward in exactly the same manner as the distributor 35, when the brush arms of these distributors arrive upon corresponding contacts a circuit will be completed between the two stations. Thus, when the brush arm 37 of the distributor 35 arrives upon the contact 43 the brush arm 39 of distributor 36 will arrive upon the contact 88 and a circuit will be completed from grounded battery 42,

through contact 41 of control key 120, contact 43 and brush arm 37 of selector 35, conductor 89, contact 66 and armature of slow releasing relay 54, line conductor 1, contact 67 and front armature of slow releasing relay 60, back armature and contact 68 of relay 60, conductor 90, brush arm 39 and contact 88 of selector 36, windings of polarized relay 8 to ground. Since the polarized relay 8 is thereupon energized by current of negative polarity its armature will be attracted to open the contact 16, thus deenergizing the power switch 2 in the manner described above. Each succeeding step of the distributors is accomplished in the same manner so that the brush arms will be stepped around in synchronism passing corresponding contacts of each distributor at the same time.

When the power switch 2 is closed, as shown in the drawing, its auxiliary contact 91 is also closed thereby connecting current of positive polarity from the battery 92 to the contact 93 of the distributor 36, but when this power switch is opened by the operator as described above, the auxiliary contact 91 will be associated with a battery 94 of negative potential and thus when the brush arm 39 of selector 36 arrives upon contact 93, and the brush arm 37 of distributor 35 arrives upon the corresponding contact 95, the polarized lamp controlling relay 24 at the central station A will be energized by current of negative polarity over a circuit extending from grounded battery 94, through auxiliary contact 91 of power switch 2, conductor 96, contact 93 and brush arm 39 of selector 36, conductor 90, contact 68 and back armature of slow releasing relay 60, front armature and contact 67 of relay 60, line conductor 1, back armature and contact 66 of slow releasing relay 54, conductor 89, brush arm 37 and contact 95 of selector 35, windings of polarized relay 24 to ground. In operating, the relay 24 opens contact 31 and closes contact 33, thus extinguishing lamp 26 and lighting lamp 27 in the manner described above. After the brush arms of distributors 35 and 36 have made one revolution, the lower brush arms 38 and 40 will engage contacts 74 and 76, respectively. As soon as this occurs the polarized relay 69 is energized by current of positive polarity over a circuit extending from grounded battery 49, through armature and contact of slow releasing relay 48, contact 70 of impulse wheel 71, conductor 72, brush arm 38 and contact 74 of distributor 35, windings of polarized relay 69 to ground. The relay 69, being energized by current of positive polarity attracts its armature to open the contact 77, thus opening the operating circuit of the stepping magnet 78 and thereby stopping the rotation of the brush arms of the distributor 35. At the

same time the polarized relay 73 at remote station B and all other remote stations is also energized by current of positive polarity, thereby opening the circuit of the stepping magnet 80 at contact 82 and stopping the rotation of the brush arms of selector 36.

The impulse wheel 71 is provided with more teeth than are necessary for a complete revolution of the distributor since the opening of the line by some of the teeth may have no effect on the line relays 51 and 52, such a condition sometimes existing when these line relays remain short circuited longer than usual due to the slow release of the armatures of relays 54 and 60 respectively. Furthermore, should one of the distributors lose a step and lag behind the others, it will continue to be stepped forward to the correcting position by the extra impulse until it catches up with the other distributors which, in the meantime, have been stopped at the end of one revolution. It will therefore be obvious that all the selectors in the system are automatically corrected or synchronized once in every revolution.

A special answer-back signal is provided for notifying the attendant at the central station A when any outlying power switch operates due to abnormal conditions when the system is at rest. This signal comprises a special pilot lamp 100, which may be of some distinctive size or color, and which is normally lighted when the system is at rest but which is extinguished upon the operation of any power switch. The extinguishment of the pilot lamp 100 is accompanied, if desired, by the ringing of a bell 101 to give an audible indication of such operation. The lamp 100 is normally lighted over a circuit extending from grounded battery 102, through armature and contact 103 of a normally energized relay 104, filament of lamp 100 to ground. The relay 104 is normally energized over a circuit extending from grounded battery 105, through winding of relay 104, contact 106 and armature of relay 104, contact 109 and armature of line relay 51 to ground. If now, the power switch 2 is deenergized automatically due say to the operation of the overload relay 15, the line conductor 1 will be momentarily opened in the following manner: A relay 110, provided at the remote station B, a similar relay being provided at all other remote stations, is normally short circuited through auxiliary contacts 111, on the power switches 2 and auxiliary contacts 112' on power switch 2', and resistance 200 but when the power switch 2 is opened the upper auxiliary contact 111 is likewise opened and the lower auxiliary contact 112 is closed, a similar operation taking place upon the operation of the power switch 2'. However, during the interval between

the opening of the contact 111 and the closing of contact 112, the short circuit across relay 110 is removed and this relay is energized over a circuit extending from grounded battery 81, through armature and contact 113 of polarized relay 73, winding of relay 110, to ground, thus attracting its armature and opening the line at the contact 114. When the line is thus momentarily opened the line relay 51 is momentarily deenergized thus allowing its armature to fall back and open the contact 109 thereby opening the energizing circuit of the relay 104 which thereupon allows its armatures to fall back and open the contacts 103 and 106. The opening of contact 103 extinguishes the lamp 100, and the closure of contact 115 energizes the bell 101 over a circuit extending from grounded battery 102, through front armature and contact 115 of relay 104, winding of bell 101 to ground, thus giving the attendant at the central station an audible as well as a visible indication of the operation of the power switch.

When a power switch at any of the outlying stations opens or closes due to abnormal conditions on the power line during the selecting operation described above, the return indication of this operation will be locked out so that there will be no interference in the system while it is in operation. This is accomplished at each of the remote stations such as station B, by the polarized relay 73 whose armature must be in engagement with contact 82 during the selecting operation in order to operate the stepping magnet 80, as described above, and therefore the contact 113 must be broken during such selecting operation and thus prevents the momentary energization of the relay 110, which, accordingly cannot open the line 1. If this were not so it would result either in such indication being lost or if station C were receiving a control impulse or sending an answer back signal at the instant contact 114 opened such control impulse or answer back signal would be lost. When, however, the lamp 100 is extinguished and the bell 101 rings at a time when the system is at rest, the attendant at the central station, knowing that a power switch has operated at one of the remote stations, will operate the key 44 and then set the impulse wheel 71 into operation in order to determine which power switch has operated. The distributors at the central station and at the remote stations will then advance in the manner previously described, their upper brush arms simultaneously passing over and searching out corresponding contacts and in turn operating the appropriate indicating relays 24 and 25 at the central station A, thus extinguishing one of the lamps associated therewith and lighting another to indicate which power switch has operated. After this op-

eration the relay 104 may again be energized over an obvious circuit by closing a normally open key 116, thereby again lighting the lamp 100 and cutting out the bell 101. It is understood that after any operation involving deenergization of relay 104, key 116 must be operated to again energize this relay.

While the invention has been shown and described in connection with the control and supervision of power switches, it is to be understood that it is equally applicable to the control and supervision of other devices or apparatus. Furthermore, since many other changes may be made in the system herein shown and described without departing from the spirit of the invention, it is to be understood that the invention is not limited in any way except as defined by the scope of the appended claims.

What is claimed is:

1. A signaling system comprising a central station and a remote station, a circuit connecting said stations, a distributor at each of said stations, an operating magnet for each of said distributors included in a circuit normally open at two points, a polarized relay at each station, means whereby the polarized relays are controlled from the central station to close the associated operating magnet circuit at one point, a line relay in said first circuit at each station to close the operating magnet circuit at the other point, and impulse transmitting means associated with said circuit at said central station for operating said line relays.

2. A signaling system comprising a central station and a remote station, a normally closed circuit connecting said stations, a distributor at each of said stations, an operating magnet for each of said distributors in a circuit normally open at two points, a polarized relay at each station, means whereby the polarized relays are controlled from the central station to close the associated operating magnet circuit at one point, a normally energized relay in said first circuit at each station to close the associated operating magnet circuit at the other point, and means at said central station for periodically opening and closing said circuit to alternately deenergize and energize said normally energized relays.

3. A signaling system comprising a central station and a remote station, a normally closed circuit connecting said station, a normally energized line relay in said circuit at each of said stations, a distributor at each of said stations, an operating magnet for each of said distributors controlled by the normally energized relay thereat, means controlled at said central station for preparing the operation of said distributor magnets, means at said central station for periodically opening and closing said nor-

mally closed circuit to operate said line relays, a slow releasing relay at each station operated upon the deenergization of the line relay thereat, means controlled by said slow releasing relays for shunting the respective line relays out of said line, and means controlled by said distributor operating magnets for deenergizing said slow releasing relays to remove said shunt.

4. A signaling system comprising a central station and a remote station, a circuit connecting said stations, a distributor at each of said stations, an operating magnet for each of said distributors included in a circuit normally open at two points, a polarized relay at each station, means whereby the polarized relays are controlled from the central station to close the associated distributor circuit at one point, a line relay in said first circuit at each station to close the operating magnet circuit at the other point, impulse transmitting means associated with said circuit at said central station for operating said line relays, and means controlled by the operating magnet at each station and operative when said distributor reaches a predetermined point to operate the polarized relay thereat to open the associated distributor circuit at the first point.

5. A signaling system comprising a central station, a remote station, a circuit connecting said stations, synchronously operated stepping distributors at said stations normally at rest, devices at said remote station, means whereby said devices are controlled from said central station over said circuit through the medium of said distrib-

utors, a signal at said central station, means whereby the signal is operated when said distributors are operating, automatic means at said remote station for operating said devices, and means associated with the circuit for operating said signal when the distributors are at rest and the devices are operated automatically.

6. A signaling system comprising a central station and a plurality of remote stations, synchronously operated stepping distributors at said stations normally at rest, a circuit connecting said stations, devices at said remote stations, keys at said central station, means whereby the keys selectively operate said devices over said circuit through the medium of said distributors, means for operating said distributors, pairs of signaling lamps at said central station corresponding to the devices at said remote stations, circuits including means controlled by said devices over said circuit to light one of the signaling lamps of corresponding pairs through the medium of said distributors, automatic means for operating said devices, a signal distinct from said signaling lamps, means whereby the signal is operated when said distributors are operating, and means associated with the circuit for operating said signal when one of said devices operates while the distributors are at rest.

In witness whereof, I hereunto subscribe my name this 21 day of November A. D., 1923.

FERDINAND ZOGBAUM.