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SIGNALING SYSTEM

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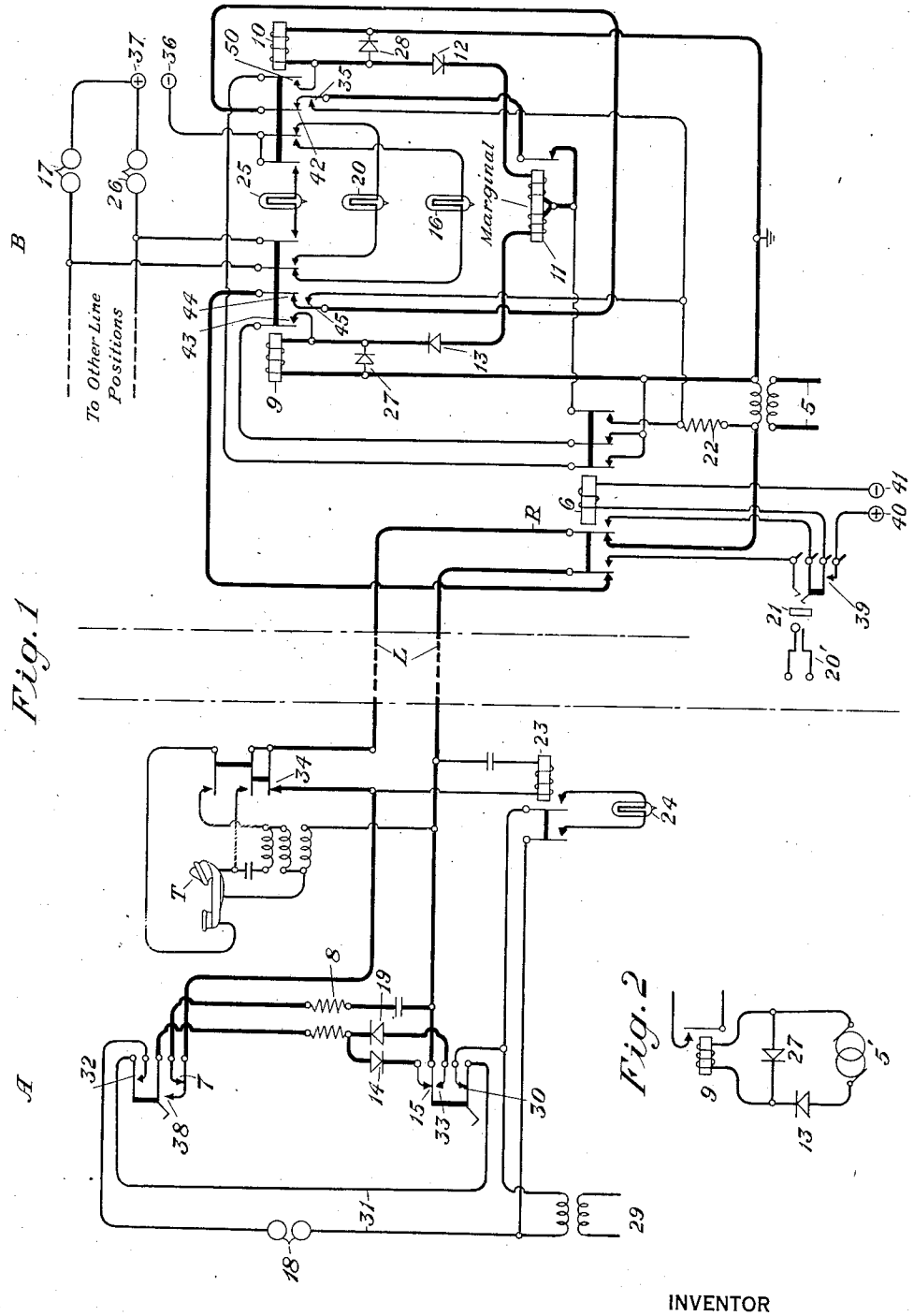


Fig. 1

Fig. 2

INVENTOR
W. M. Bacon
BY
ATTORNEY

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SIGNALING SYSTEM

Walter Meredith Bacon, New York, N. Y., assignor to American Telephone and Telegraph Company, a corporation of New York

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This invention relates to signaling and to alarm systems, and more particularly to municipal emergency alarm systems.

It is an object of this invention to provide an alarm system whereby the general public may get into communication with a central station or headquarters for the purpose of reporting fires, accidents or police alarms. In accordance with one feature of this invention means are provided whereby police or other officials may also get in touch with the central station or headquarters to give general reports or special alarms. In accordance with another feature means are also provided whereby the police signals can be distinguished instantly from the signals sent in by the general public.

The invention will be more fully understood from the following description when considered in connection with the accompanying drawing in which one form of the invention is diagrammatically illustrated in Figure 1 and Fig. 2 diagrammatically shows apparatus for holding a relay, similar to certain types of relay of this invention, continuously operated by interrupted current.

As shown in the drawing, the invention consists fundamentally of alarm boxes distributed throughout a municipality and a central alarm headquarters where signals are received. Each alarm box consists of a ruggedly constructed housing containing a telephone set, ringing equipment and the apparatus required to send in the alarm. At each box a local gong is provided which rings and attracts attention to the box where the gong is operated and an alarm is being sent by the general public. A method of attracting attention to this box by means of a lamp or loud gong under the control of the central headquarters operator is also provided. The headquarters station consists of a telephone switchboard in which conductors from each of the alarm boxes terminate as well as special trunks from the central offices of the local telephone company and other places from which special calls may be received. Each line termination appears on the headquarters switchboard as a jack, and associated with each jack are three signal lamps. One of these lamps provides a green light to indicate the police signal, another lamp provides a red light to indicate a fire or public alarm signal, and a third lamp a white light which indicates a trouble condition on the line.

In systems of the above character continuous supervision of the line circuit may be provided so that open grounded or short-circuit conditions are instantly indicated at the headquarters.

The system involved in this invention is so designed that if the public sends an alarm the following takes place: The person sending the alarm opens the door of the alarm box, which instantaneously lights a red lamp associated with that particular box at the headquarters. On opening the door of the box a telephone set is available and may be used to report the details of the alarm to the operator at the headquarters board who, on reception of the lamp signal, has answered it by inserting the plug of her cord circuit in the jack connected to that particular box. In this way even if the person wishing to transmit an alarm is unable to use the telephone in the box, due to excitement or other causes, the operator will instantly know from which box the alarm is being transmitted and help can be dispatched immediately. At the same time as the person transmitting the alarm opens the door, a loud local alarm mounted near the box rings to attract attention to the box, so that police or other officials in the neighborhood may act at once, and thus false alarms will be discouraged.

When a patrolman or other official desires to communicate with alarm headquarters from one of these street boxes, he first inserts a key in the door or side of the box and then opens the box door. The opening of the door after the insertion of the special key brings up the green light associated with that particular box at the headquarters. He then proceeds by telephone to give the desired message or information to the operator. The insertion of the key in the box disconnects the loud local gong so that it does not ring when the door is opened for the transmission of an official message.

If the headquarters operator desires to call a patrolman known to be near a certain box, she may do so at any time by ringing over the circuit which operates either a signal gong or signal lamp at the box location.

The circuit used in this system is a normally closed circuit supplied with alternating current, as, for example, low-voltage 60-cycle A. C. power. This power is connected to the line conductors at all times except when the circuit is actually transmitting an alarm.

In the drawing there is shown a substation A which is connected to the central office or headquarters B by means of a line L. Normally with the alarm box door at the substation A closed, the circuit is as follows: From alternating current

power source 5, over left terminal of a power transformer, left inner normal contact of relay 6 at headquarters station B, over one side of the line L through the closed switchhook contact 34 of the telephone set T at station A, through the normally closed contact 7, through resistance 8 and associated condenser to the other side of the line L, back to the headquarters station B, through the outer left normally closed contacts of relay 6, middle make contact of relay 9, normally closed middle contact of relay 10, contact of marginal relay 11, where the circuit splits, half of the alternating current going through the right winding of relay 11 and copper oxide rectifier 12 in one direction and the other half through the left winding of relay 11 and copper oxide rectifier 13 in the other direction, through the windings of relays 9 and 10, respectively, and back to the source of power 5 through the right hand contact of the power transformer. In this way relays 9 and 10 are normally operated and relay 11, which is a marginal relay, is normally released due to the limitation of the currrent in the circuit by the resistance of the line and the resistance 8 at the substation A.

When a public alarm is transmitted from the alarm box at station A, the opening of the alarm box door breaks contact 7 which removes the resistance 8 and associated condensers normally bridged across the line conductors L and substitutes in their places copper oxide rectifier 14 and associated resistance which is connected to the line through contact 15. The circuit then established includes the left-hand normal inner contact of relay 6, one side of line L, closed switchhook contact 34, contact 36, resistance associated with rectifier 14, rectifier 14, contact 15, the other side of line L, left-hand normal outer contact of relay 6, contact 44 of relay 9, contact 42 of relay 10, contact of relay 11, left-hand winding of relay 11, rectifier 13, winding of relay 9, back to the secondary winding of the power transformer. The rectifier 14 permits only half of the alternating current to flow through the circuit over line conductors L, so that the current now flowing is interrupted, direct current flowing in one direction only. It will be apparent that this unidirectional current flowing over the line conductors through the windings of relay 11 meets the rectifiers 13 and 12, one of which opposes its flow and the other of which permits it to pass. In this instance the current is permitted to flow through rectifier 13 through winding of relay 9, thereby holding this relay operated. It cannot flow through rectifier 12, which is poled opposite to rectifier 13 and relay 10, therefore, releases. When relay 10 releases, it locks itself unoperated by the closing of the circuit at contact 50 of the relay 10. This locking circuit just referred to extends from the left-hand contact of the winding of relay 10, contact 50 of the relay 10, the right-hand innermost contact of relay 6 and back to the right-hand contact of the winding of relay 10. During this condition the headquarters relay equipment is removed from the line L at contact 42 of relay 10 and at the same time, relay 9 is locked in operated position through contact 35 of relay 10. Relay 9 is locked operated through the following circuit. Right-hand side of secondary of transformer 5, winding of relay 9, rectifier 13, left-hand winding of relay 11, contact of relay 11, contact 35 of relay 10, back to left-hand side of the secondary of the transformer 5 through resistance 22. The contacts of relay 10 also cause the public signal lamp 16 to light and the general alarm gong 17 to sound. This circuit extends from minus power terminal 36, left contact of relay 10, lamp 16, right contact of relay 9, gong 17 to plus power terminal 37. The person transmitting the alarm, upon removing the telephone set from the switchhook at the box, connects the telephone equipment to the line through the upper contacts of the switchhook and removes all the other box equipment from the line by opening the circuit at switchhook contacts 34. At the same time that the door of the alarm box at station A is opened, a circuit is established from power source 29, contact 30, conductors 31, contact 32, and the local gong 18 back to power source 29. The closing of this circuit causes the local gong 18 at station A to sound.

When a patrolman uses the box at station A he first inserts a key, which breaks contacts 15 and 30 and makes contact 33. He then opens the box door, which breaks contact 7 and makes contact 36 and connects rectifier 19 through make contact 33 and switchhook contact 34 across the line. This permits the current to flow over line conductors L in only one direction, which is opposite to that in which it flowed over said conductors for a public alarm as just described. In this instance the current passes from the right-hand contact of the secondary of transformer 5, normally closed inner left-hand contact of relay 6, line L, switchhook contact 34, contact 36, rectifier 19 and associated resistance contact 33, line L, outermost left-hand contact of relay 6, contact 44 of relay 9, contact 42 of relay 10, contact of relay 11, right-hand winding relay 11, rectifier 12, winding of relay 10, back to the right-hand contact of the secondary of transformer 5. This holds relay 10 operated but releases relay 9 as no current passes through rectifier 13 which is poled opposite to rectifier 19. The locking path of relay 10 extends from the right-hand contact of the secondary of transformer 5, winding of relay 10, rectifier 12, right-hand winding of relay 11, contact of relay 11, contact 42 of relay 10, contact 45 of relay 9, resistance 22 to the left-hand contact of transformer secondary 5. The contacts of relay 9 lock it in the unoperated position through the closure of its contact 43 which is included in a circuit with the second contact at the right of relay 6. By virtue of the opening of contact 44 of relay 9, relay apparatus at the central stations B is removed from the line L normally connected through this contact. Relay 9 through its contacts also lights the police lamp 20 and operates the office alarm gong 17. This circuit extends from minus terminal 36 through the normally closed contact of relay 10, lamp 20, off normal contact of relay 9, gong 17 to positive terminal 37. When the patrolman removes the telephone set at station A, the switchhook contacts connect the set to the line conductors L and remove the rest of the box equipment from the line at switchhook contact 34. The breaking of contact 30 at station A by the insertion of the patrolman's key opens the circuit of the local gong 18, which in this case does not sound when the door is opened.

In answering either the police signal lamp 20 or the public signal lamp 16, the headquarters operator inserts plug 20' into jack 21, thereby operating relay 6 over a circuit from plus terminal 40 through contact 39, winding of relay 6 to minus terminal 41 and at the same time removes the line completely from the relay equipment through the left-hand contacts of relay 6 and connects the operator's cord circuit in its

place. The operation of relay 6 breaks the locking circuits of relays 9 and 10 at the first and secondary hand contacts of relay 6. At the same time the operation of relay 6 causes relays 9 and 10 to operate this circuit extending from the left-hand contact of the secondary of transformer 5, resistance 22, right outermost contact of relay 6, the two respective windings of marginal relay 11, rectifiers 13 and 12, windings of relays 9 and 10 respectively back to the right-hand contact of the secondary of transformer 5. Conversation may now take place between the operator at central station B and whoever may be using the telephone set at the substation A.

After the conversation between the operator and the person transmitting the alarm has been completed, the operator removes the plug 20', and if no further signals come in, knows that the telephone has been replaced on the switchhook at substation A and the door of the alarm box thereat has been properly closed. If the alarm box door had been left open, or the telephone set has not been replaced, she would be notified by the fact that as soon as she removed the plug 20', one of the signal lamps 16, 20 or 25 would appear over one of the other circuits previously traced in connection with the operation of these lamps.

If the operator wishes to signal the patrolman at the station A, she plugs into the jack associated with the box at that station. This causes the operation of relay 6 and removes all terminal equipment at the central station B from the line as formerly described, and she can then ring through to the station A by means of ringing current of a frequency other than that used for the normal line condition (in this case 60 cycles for normal, 20 cycles for ringing), the condenser 19 being of such capacity as to easily pass 60 cycles but not 20 cycles so that current must go through relay 23 which, in series with its associated condenser, is tuned for 20 cycles. The ringing current is supplied over her cord circuit in a well understood manner. The ringing current operates ringing relay 23 at station A and signal 24 is operated through the following circuit. Right-hand contact of power source 29, inner contact of relay 23, signal 24, outer contact of relay 23, to the right-hand contact of power source 29. In response to this signal the patrolman at the substation will open the door by means of a key and remove the telephone set thereat establishing a talking connection with the operator.

The supervisory features of this circuit operate as follows: If the line goes open instantaneously or for a long period of time relays 9 and 10 both release as the circuit through their winding is broken and trouble lamp 25 at the central station B lights and the general trouble gong 26 at the central office B operates. This circuit extends from minus terminal 36 through the extreme left-hand contact of relay 10, lamp 25, extreme right-hand contact of relay 9, gong 26 back to positive terminal 37. If a ground appears on either side of the line, both relays 9 and 10 release due to the fact that a current path is set up between the ground on the line L and a permanent ground on one side of the source of power 5, at the headquarters station and trouble light 25 lights to show a troubled condition. This also operates the general trouble gong 26. The lighting of lamp 25 and the operation of the gong 26, is accomplished by means of the circuit as described in the case of an open line condition. If the line is short circuited an increase in current immediately results due to the shunting of the resistance 8 at the alarm box and marginal relay 11 operates breaking the circuit at its contact and releasing both relays 9 and 10 which brings in the trouble condition as described above. The trouble lamp remains lit until relay 6 has been operated and the relay apparatus returned to normal.

In order to maintain relays 9 and 10 operated on the interrupted direct current which flows through their windings they are shunted by rectifiers 27 and 28, respectively, which act as unidirectional shunts for these relays. These shunt circuits provide means for holding the relays 9 and 10 operated if either of these relays tends to be opened for a predetermined interval. It is also shown and described in connection with Fig. 2.

The circuit for holding either or both of the relays 9 and 10 operated while pulsating or rectified current is flowing therethrough may be better understood in connection with the arrangement shown in Fig. 2. Here an alternating current source 5' is connected to the winding of relay 9, the interconnecting circuit including a unidirectional device 13 or other interrupter. The winding of relay 9 is shunted by another unidirectional device 27 which is poled in opposition to the device 13 when viewed from the source 5'.

Upon the interruption of current from the source 5' caused by the opposition of the rectifier 13 the magnetic field of relay 9 tends to collapse, thereby tending to release the armature of this relay. The release of the armature is made impossible for a short interval in the circuit by virtue of the presence of the shunt circuit including the rectifier 27.

As the magnetic field of the relay 9 decreases in amplitude a voltage is set up across the winding of relay 9 the magnitude of which depends in part upon the resistance of the winding as well as upon the number of turns therein and the size of the iron core. This voltage causes a flow of current through the shunt circuit of the rectifier 27, and this current is in such a direction as to maintain the armature of the relay continuously closed against its make contact.

Thus it will be seen that as pulsating current flows through the winding of relay 9, the tendency of the armature to release is completely eliminated by virtue of the presence of the rectifying device 27. It will be understood that the use of any other unidirectional device may be inserted in place of the rectifier 27.

It will be apparent that the arrangement shown in Fig. 2 may be employed in preventing relays and translating devices in general from releasing during brief intervals of time when current from the primary source may be interrupted, and also may be used to make such devices slow release when current is completely cut off. This arrangement provides a circulating path through which is transmitted a current corresponding to the voltage built up across the winding of the relay or across the translating device at the very time when the current therethrough might be insufficient to maintain these devices continuously operated.

What is claimed is:

1. In an alarm system, a central station, a substation connected thereto, first and second keying devices at said substation, first and second normally operated relays at the central station corresponding to said substation, means responsive to the operation of the first keying device at the substation for maintaining the corresponding first

relay operated and for deenergizing the second relay, means responsive to the operation of the first and second keying devices at the substation for operating the corresponding second relay and for deenergizing the first relay, and means for operating both the first and second relays corresponding to the substation when both the first and second keying devices are unoperated.

2. The combination of a main station, an auxiliary station, first and second switches at the auxiliary station, two relays at the main station, means responsive to the operation of the first switch for transmitting pulsating current through one of said relays, means responsive to the operation of the first and second switches for transmitting pulsating current through the other of said relays, means for operating both relays by pulsating current when both switches are unoperated, and means including a unidirectional device connected in shunt with the winding of each relay for maintaining each relay continuously operated while pulsating current is supplied thereto.

WALTER MEREDITH BACON.