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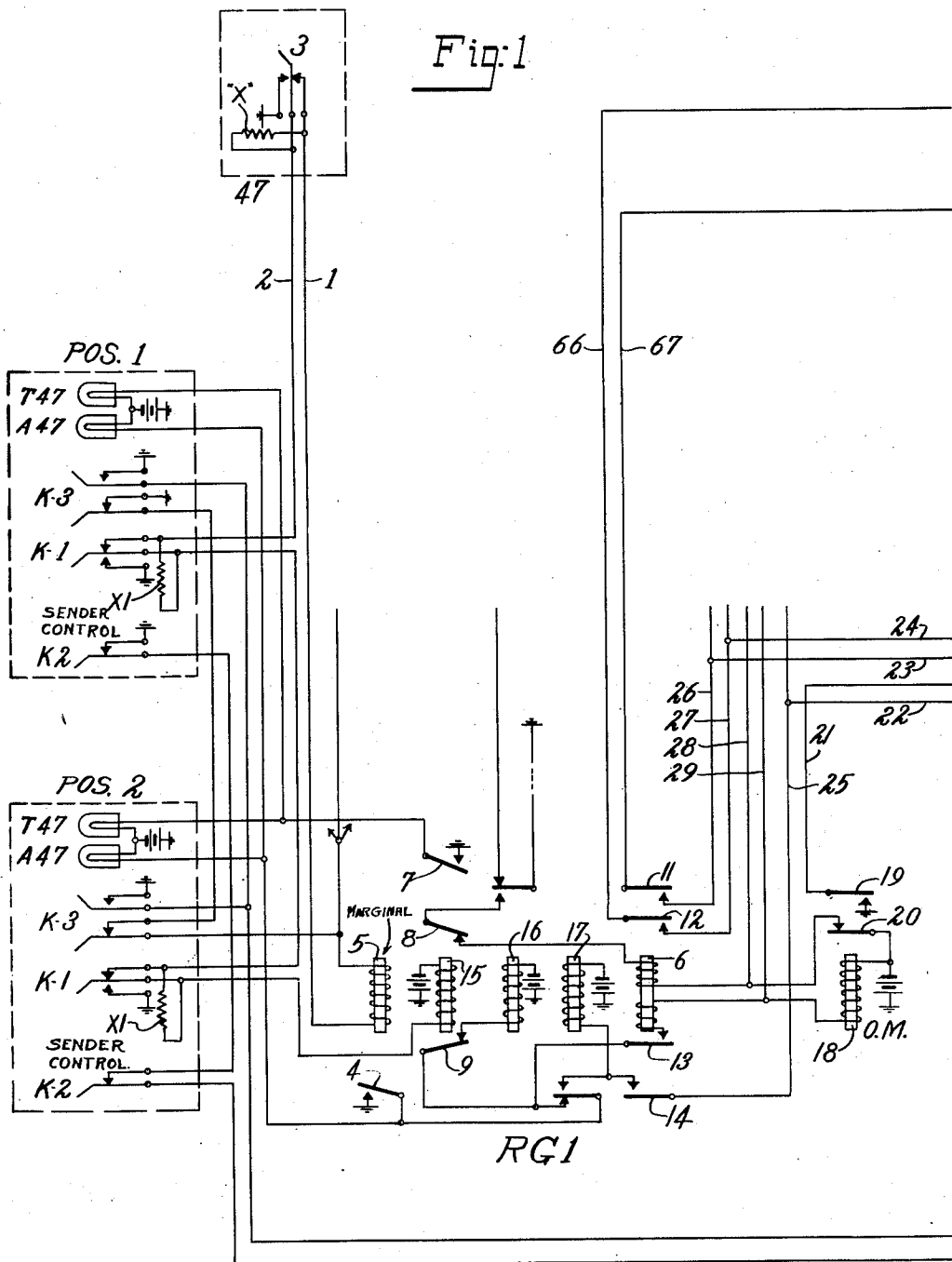
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1,772,671

SIGNALING SYSTEM

Filed May 31, 1928

2 Sheets-Sheet 1



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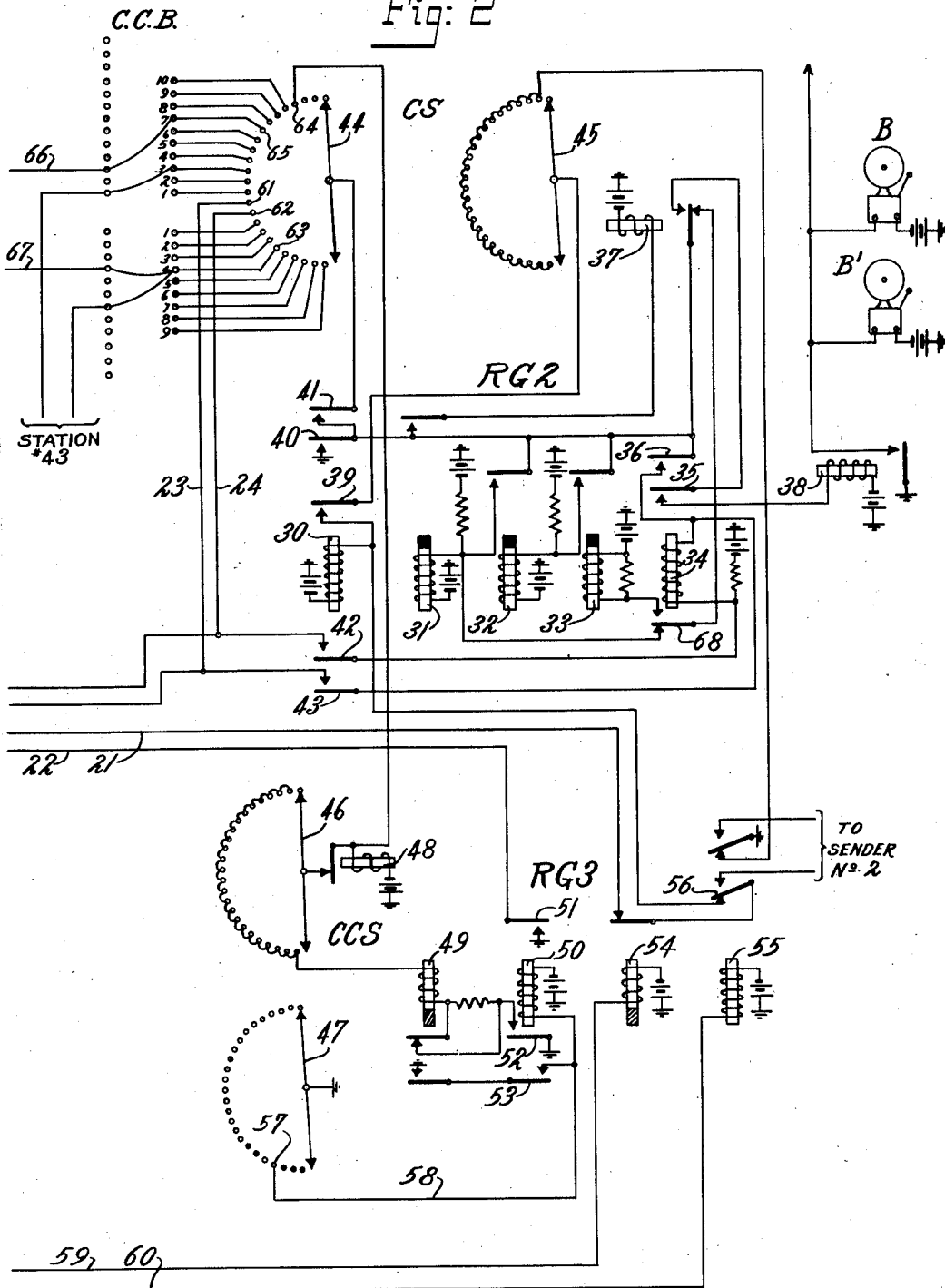
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Fig. 2



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SIGNALING SYSTEM

Application filed May 31, 1928. Serial No. 281,721.

The present invention relates in general to signaling systems, but is particularly concerned with the provision of equipment suitable for use as a fire alarm system. The system herein disclosed is of the same character as that disclosed in my application, Serial No. 174,449, filed March 11, 1927, British patent No. 302,409, and on which this application is a direct improvement.

My new invention contains all of the features of my previous application. In addition, it contains features which provide for the turning in of an alarm from the fire alarm box, even though the positive side of the line connecting that box with the central station be open, and which provide for the turning in of an alarm from the supervisor's position, regardless of the line condition of the alarm box whose code is to be sent; that is, even though one or both sides of the line are open.

The foregoing features and others not specifically mentioned are attained by the equipment disclosed in the accompanying drawings comprising Figs. 1 and 2.

In order to consider the system as a whole, Fig. 2 should be placed at the right of Fig. 1, with the corresponding lines in alignment. In Fig. 1 is shown a fire alarm station or box designated as No. 47, having the equipment shown diagrammatically within the dotted rectangle.

This box, or station, is of the usual type, wherein contacts are normally held in an actuated position under spring tension by a pane of glass in the face of the box and are released by the breaking of the glass to turn in an alarm.

At the central or supervisory station, each line terminates in a relay group individual to it; for instance, the relay group RG1 is individual to the line terminating in alarm box No. 47.

At the lower right-hand corner of Fig. 1 is a relay 18 which is termed an open main relay and which is common to all lines of the system. The purpose of this relay will be explained subsequently.

At the left side of Fig. 1 and included within the dotted rectangles designated "Posi-

tion 1" and "Position 2" are shown the supervisory and testing equipments. Each of these equipments includes keys for making various tests of the line conditions and of the equipment shown in Fig. 2, and also includes a pair of lamps individual to each line terminating in a relay group such as RG1. One of these lamps is for giving trouble indications, while the other indicates that the corresponding station has turned in an alarm.

The equipment of Fig. 1 is inter-connected with the common equipment shown in Fig. 2, which equipment consists in the main of a code sender switch CS, the relay group RG2 which controls the function and operation of the code sender switch, and a code cut-off switch CCS which determines the number of times the code will be transmitted before it is cut off. A pair of ordinary bells, B and B', are indicated as the signaling devices responsive to the various codes. A cross-connecting block CCB is also provided for the purpose of connecting up additional fire station lines, removing existing ones, and also changing the codes of existing fire stations, should occasion require.

The apparatus having been described in general, its operation will now be explained in detail with reference to the hereinbefore mentioned drawings.

It will be assumed that a person has discovered a fire somewhere in the vicinity of fire alarm box No. 47 and, therefore, breaks the glass in the face of the box to send in an alarm. The breaking of the glass releases spring 3 and permits it to assume an alternate position in connection with its grounded back contact and also cuts the resistance X in the series circuit of relay 5 and 15.

This circuit ordinarily extends from battery, winding of relay 15, normally closed contacts of key K1 Position 2, normally closed contacts of key K1 Position 1, conductor 2, normally closed contacts 3, conductor 1, winding of relay 5, normally closed contacts of key K3 Position 2, to ground through normally closed contacts of Key K3 Position 1.

The resistance of the winding of relay 15 is much higher than that of the relay 5. Therefore, when the resistance X is inserted

in series with these relays, the current flow is reduced sufficiently to cause marginal relay 5 to restore, while relay 15 remains energized. Relay 5, at spring 4 and its ground resting contact, completes a circuit for the signal lamps A47, causing them to glow and indicate that an alarm has been turned in from box 47.

Ground is also transmitted from the spring 4 of relay 5 over the spring and resting contact of relay 17, spring 9 and working contact, to the winding of relay 16 and battery, causing this latter relay to also operate. Relay 16, upon operating, completes a circuit from ground on its spring, its working contact, spring 8 and its working contact, upper winding of relay 6, and spring 20 and its resting contact of the open main relay 18 to battery. There is ground on the spring of relay 16 either because station 47 represents the first of a number of lines, or because of ground being applied to it through series contacts of relays corresponding to relay 16.

Relay 6 operates in the above-traced circuit and completes a locking circuit for itself and an energizing circuit for relay 18 as follows: spring 4 and grounded resting contact of relay 5, spring and resting contact of relay 17, spring 13 and working contact of relay 6, lower winding of relay 6, and the winding of relay 18 to battery.

Relay 18 operates in this circuit and, upon operating, at its spring 20 removes battery from the upper winding of relay 6, and at its spring 19 and its working contact applies ground to conductor 21 to start the code switch CS. This ground extends over the conductor 21, through the resting contact and spring of relay 54, spring 56 and working contact of relay 55, and the winding of relay 30 to battery.

Diverting our attention now to the operation of the code sender, it will be seen that responsive to the closure of the circuit just traced relay 30 operates. This relay at its spring 41 closes the circuit at that point of the code pick-up wiper 44, at its spring 39 prepares a locking circuit for itself through the wiper 45 which becomes associated with the grounded contacts of its bank as soon as the code switch moves off normal, at its springs 42 and 43 closes at those points the circuit of the code control relay 34, and at its spring 40, completes an energizing circuit for the slow-to-release relay 31. The circuit of this relay extends via grounded working contact and spring 40, spring and resting contact of the motor magnet 37 of the code switch, spring 68 and resting contact of relay 34, and the winding of relay 31 to battery.

Relay 31, upon operating, completes a circuit for motor magnet 37, causing it to energize and break the previously described circuit for slow-to-release relay 31. This relay an instant later restores and opens the energizing circuit of magnet 37, causing the

switch to advance one step. The restoration of magnet 37 causes the circuit of relay 31 to be completed again. It will be seen from this that the motor magnet 37 will cause the associated wipers 44 and 45 to be advanced in a clock-wise direction due to the inter-action of motor magnet 37 and slow-to-release relay 31. This inter-action continues until the wiper 44 encounters the tens contact corresponding to the tens digit of the station from which an alarm has been turned in; in the present instance, this digit is 4 and is designated as contact 63 in the bank of the code sender.

When the wiper 44 encounters the bank contact 63, ground is transmitted from the grounded contact and spring 40 of relay 30, through wiper 44, bank contact 63, the associated jumper of the cross-connecting block, conductor 67, spring 11 and its front contact, conductor 26, conductor 23, working contact and spring 43 of relay 30, the winding of code control relay 34, and the associated resistance to battery. The relay 34, upon operating, at its spring 35 connects the code signal relay 38 with the working contact of motor magnet 37 so that each time magnet 37 operates relay 38 will operate to send out a portion of the selected code. Relay 34 also at its spring 68 breaks the initial operating circuit of slow-to-release relay 31 and completes the circuit for slow-to-release relay 33. Relay 33 in turn completes a circuit for slow-to-release relay 32 which, in turn, completes a circuit for the slow-to-release relay 31.

The purpose of introducing the additional relays 32 and 33 in the circuit at this time is to slow up the operation of the code sender while it is actually sending a code, as it will readily be seen that now, before the circuit of the magnet 37 can be broken, all three of the relays 33, 32, and 31 must be restored. The delay in introducing the relays 32 and 33 into the controlling circuit of the code sender until the code is actually to be transmitted enables the lapse of time between the time the alarm is turned in and the time when the code is started to be kept at a minimum.

The inter-action of magnet 37 and relays 33, 32, and 31 continues until the wiper 44 arrives at its bank contact 62, at which time the relay 38 will have been operated four times. When this occurs, ground is transmitted from the wiper 44 via conductor 24, working contact and spring 42, and the winding of relay 34. This ground shunts battery from relay 34, causing it to restore to disconnect the alarm control relay 38 from control of the motor magnet of the code switch, and is for the purpose of introducing a delay between the transmission of the first and second digits of the code.

When the wiper 44 arrives at its bank contact 61, ground is transmitted by way of conductor 23, working contact and spring 43, to

the other terminal of relay 34 so that that relay is again energized to permit the transmission of the second digit of the code. In the example under consideration, when wiper 44 arrives at contact 65, seven impulses have been transmitted to relay 38 and a circuit is completed for restoring the code control relay 34 as follows: grounded wiper 44, bank contact 65, through the jumper of the cross-connecting block, conductor 66, spring 12 and its front contact, conductor 27, conductor 24, spring 42 and its make contact, to the resistance associated with relay 34 and to the relay 34, causing that relay to be shunted out as before.

As soon as the wiper 44 arrives at the contact 64, an impulse is transmitted to the motor magnet 48 of the code cut-off switch CCS, which advances its wipers 46 and 47 as soon as the wiper 44 leaves the contact 64.

The relay group RG2 of the code sending switch and the code sending switch itself are now in the same position as when the relay 30 was first energized. Therefore, the code switch is again operated to retransmit the code previously transmitted. By the transmission of each code the foregoing described circuit for motor magnet 48 of the code cut-off switch is operated. After the particular code has been repeated a number of times corresponding to the number of steps required for the wiper 47 of the code cut-off switch to encounter its bank contact 57, the circuit is completed for relay 50 over conductor 58. Relay 50, upon operating, at its spring 52 connects ground to the bank contacts of wiper 46 through the winding of slow-to-release relay 49. This latter relay completes a locking circuit for relay 50 at its lower spring, which circuit is maintained as long as wiper 46 encounters ground.

The motor magnet 48 now interrupts its own circuit and the wipers 46 and 47 are advanced to their normal position as shown, and relay 49 then restores and opens the locking circuit of relay 50 which also restores.

Coming back to what takes place when relay 50 operates, that relay, in addition to closing the restoring circuit of the code cut-off switch and causing its restoration, at its spring 51 connects ground to the conductor 22 which, in turn, is connected at this time to the winding of relay 17 by way of conductor 25 and the spring 14 and working contact of relay 6. The relay 17 now operates and at its spring and back contact opens the circuit of relay 16 and the locking circuit of relay 6 and the open main relay 18, and at its front contact completes a locking circuit for itself. Due precaution is taken to insure the locking up of relay 17 through its spring and working contact before its energizing circuit is broken by the restoration of relay 6, this being readily accomplished by the proper adjustment of the affected arma-

tures. Relay 6, upon restoring, places the line equipment associated with station No. 47 in its initial condition so far as the code sending control circuits are concerned. When the switch 3 at station 47 is restored to normal, relay 5 is again energized and it disconnects ground from the locking circuit of relay 17. This latter relay, therefore, also restores.

Relays 16 and 18, upon restoring, restore the normal battery and ground condition of the common circuits so that if any other station has turned in an alarm its code will now be transmitted. If that is the case, open main relay 18 again operates from another relay group associated with another fire station over a circuit similar to that provided for it by the relay group RG1, ground being removed from the operating circuits of all relays preceding it corresponding to relay 6 by the associated chain contact of the relay corresponding to 16, and the battery being removed from all relays following it corresponding to the relay 6 as more fully shown in the above mentioned British patent.

Since only one relay corresponding to relay 6 can be operated at a time, only one line can control the code sender at a time because when any relay corresponding to 16 is operated, all the other corresponding relays, although operable, are rendered ineffective until the code in process of transmission has been completely transmitted. This, however, does not in any way prevent the individual line signal corresponding to A47 operating, so that if a supervisor is observing the visual signals, there need be no delay in giving an alarm regardless of the number being turned in at the time.

If in any case an alarm is turned in over a line which is short-circuited, no harm results because relay 5, for instance, is not fully dependent upon the resistance X to cause it to restore. Instead, that relay will be short-circuited by ground supplied to it from the alternate contact of spring 3 and the code will be transmitted in the manner intended.

In case the alarm circuit should go open at any time, both relays 5 and 15 will be restored. The relay 15, in addition to giving the usual visual alarm for the station which is defective, at its spring 8 opens its own branch of the chain circuit, thereby preventing the transmission of the code and at its spring 7 and its resting contact closes the circuit for the trouble lamp T47, individual to that station, so that the supervisor is advised that there is a case of trouble. At its spring 9 relay 15 opens the circuit of relay 16 so that this relay will not operate from ground on spring 4 of relay 5 and prevent any other station from controlling the code sender.

If it is the positive side, conductor 1, of the line which is open, an alarm may be

turned in from station 47, for when switch 3 assumes its alternate position, ground will be placed upon conductor 2 and relay 15 will be operated. Thus, with relay 15 operated and relay 5 deenergized, the condition will be the same as if resistance X had been inserted in the circuit of relays 5 and 15 to cause the deenergization of relay 5.

Either supervisor at the Positions 1 and 2 may send in an alarm for station 47, or any other station terminating in those positions, regardless of the line condition. This is done by the operation of either key K1. If the line is in normal condition, the operation of either key K1 inserts the corresponding resistance X1 in the circuit of relays 5 and 15 to deenergize relay 5 to start the code sender as before described.

If either side, or both sides, of the line is, or are, open, the relays 5 and 15 will both deenergize, as said before. Therefore, the operation of either key K1 will connect ground to the winding relay 15 to cause that relay to operate and condition the relay group RG1 for starting the code sending switch.

If either of the supervisors at any time desires to test the code equipment to see whether or not it is functioning properly for any particular line, either one may operate the key K1, individual to the particular line that might be doubtful, and cause the code sending equipment to function in the same manner as if an alarm had been turned in from that particular station. On the other hand, if it is desired to test the various trouble and fire lamps to see if there is any trouble with them or their circuits, either key K3 will be operated. The operation of either key K3 removes ground from all the relays corresponding to 5 and 15, and accordingly the trouble lamps of all stations will be lighted if everything is in proper condition. If any one of the lamps fails to light, the supervisor will know that there is a case of trouble. At the same time key K3 also places ground on conductor 59 to energize slow relay 54 which at its contacts opens a point in the energizing circuit of relay 30 to prevent the operation of the code sender CS.

If the code sending switch becomes defective, either supervisor may operate the associated key K2, causing relay 55 to deenergize to substitute another code sender for the defective one. Relay 55 is kept under test at all times so that should it become defective it will automatically substitute another code sender for the one shown in the drawing, thus decreasing the possibility of a supervisor's being unable to change senders, if desired.

From the foregoing, it will be appreciated that I have designed a fire alarm system which is an improvement over that system covered by my co-pending application by providing ways in which alarms may be

turned in from a station even though the positive side of the line may be open and from any supervisor's position regardless of the line condition.

What I consider new and desire to have protected by Letters Patent is pointed out in the appended claims.

What is claimed is:

1. In a signaling system, a fire alarm station, a central office, a normally closed two conductor circuit comprising a positive and a negative conductor connecting the station with the office, a pair of relays in said circuit, one connected to each of said conductors, said relays energized when the circuit is closed and deenergized when the circuit is open, means at the station for causing the deenergization of the relay in said positive conductors while the circuit is closed and causing the energization of the relay in said negative conductor while the positive conductor of the circuit is open, equipment at the office responsive to the deenergization of the positive conductor relay in one case and the energization of the negative conductor relay in the other case for sending a coded signal, and means at the office for causing the deenergization of the positive conductor relay while said circuit is closed and for causing the energization of the negative conductor relay while either or both conductors of the circuit are open to cause said equipment to send the coded signal.

2. In a signaling system, a fire alarm station, a central office having equipment for sending the coded signal of that station, a normally closed line circuit connecting the station with the office, a pair of relays normally energized in the circuit for controlling the operation of the equipment, means at the station for deenergizing one of said relays when turning in an alarm signal under normal conditions to cause the operation of the equipment to send the coded signal, means responsive to a case of trouble on said lines for deenergizing both of said relays so that said code equipment cannot operate, and a supervisor's position having means for turning in an alarm while there is trouble in said circuit by duplicating normal line conditions in the office.

3. In a signaling system, a fire alarm station, a central office having equipment for sending the coded signal of that station, a normally closed two-conductor line circuit connecting the station with the office, a pair of relays at the office for controlling the operation of the equipment, said relays normally energized in said circuit, means at the station for inserting a resistance in said circuit and for grounding one conductor of said circuit to deenergize one of said relays when turning in an alarm signal under normal conditions to cause the operation of said equipment to send the coded signal, means

responsive to a case of trouble in said circuit outside said office for deenergizing both of said relays so that said code equipment cannot operate and a supervisor's position having means for turning in an alarm while there is trouble in said circuit by grounding one side of the circuit in the office to duplicate normal line conditions therein.

4. In a signaling system, a firm alarm station, a central office having equipment for sending the coded signal of that station, a normally closed line circuit connecting the station with the office, a pair of relays normally energized in the circuit for controlling the operation of the equipment, means in the station for deenergizing one of said relays when turning in an alarm signal under normal conditions to cause the operation of the equipment to send the coded signal, means responsive to a case of trouble on said line for deenergizing both of said relays so that said code equipment cannot operate, a supervisor's position having means for turning in an alarm while there is trouble in said circuit by duplicating normal line conditions in the office, and a signal at said position operated by one of said relays to indicate said trouble.

5. In a signaling system, a fire alarm station, a central office, a normally closed two-conductor circuit comprising a positive and a negative conductor connecting said station with said office, a relay at said office connected to said positive conductor and another relay connected to said negative conductor, means at said station for normally maintaining said relays energized when said circuit is closed, means responsive to the sending in of an alarm to said station for deenergizing said positive conductor relay while said circuit is closed and for holding said negative conductor relay energized while said positive conductor is open, equipment at said office responsive to the operation of said relays for transmitting a coded signal corresponding to said station, means responsive to a break in said positive conductor when said station is at normal for deenergizing said negative conductor relay to operate a trouble signal at said office, and means in said office for causing the deenergization of said positive conductor relay and the energization of said negative conductor relay to cause said equipment to send out the coded signal to said station.

In witness whereof, I hereunto subscribe my name this 29th day of May, A. D. 1928.

CLARENCE E. LOMAX.