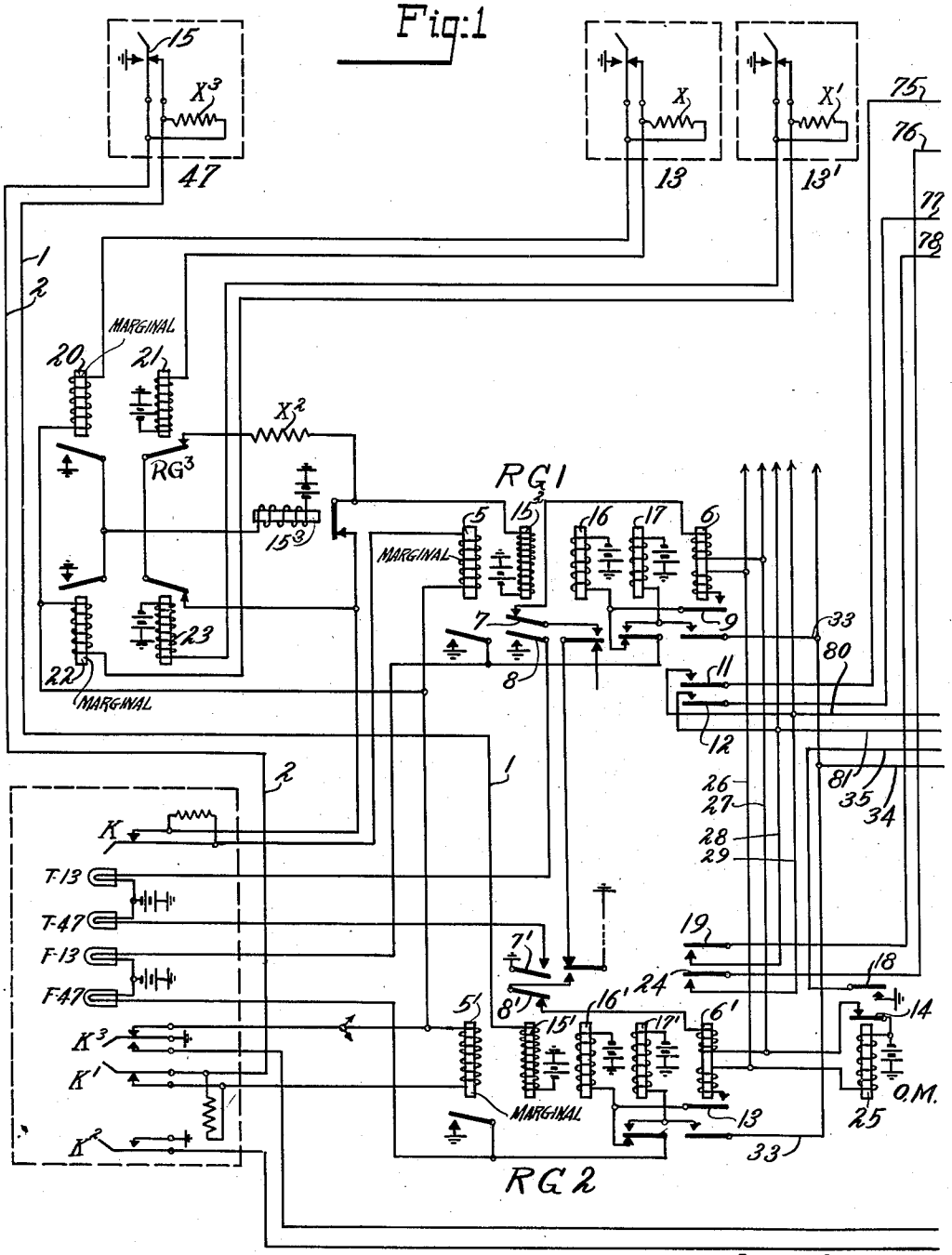
Aug. 16, 1932. C. E. LOMAX 1,871,457

SIGNALING SYSTEM

Filed March 11, 1927 2 Sheets-Sheet 1

Fig:1



Inventor

Clarence E. Lomax

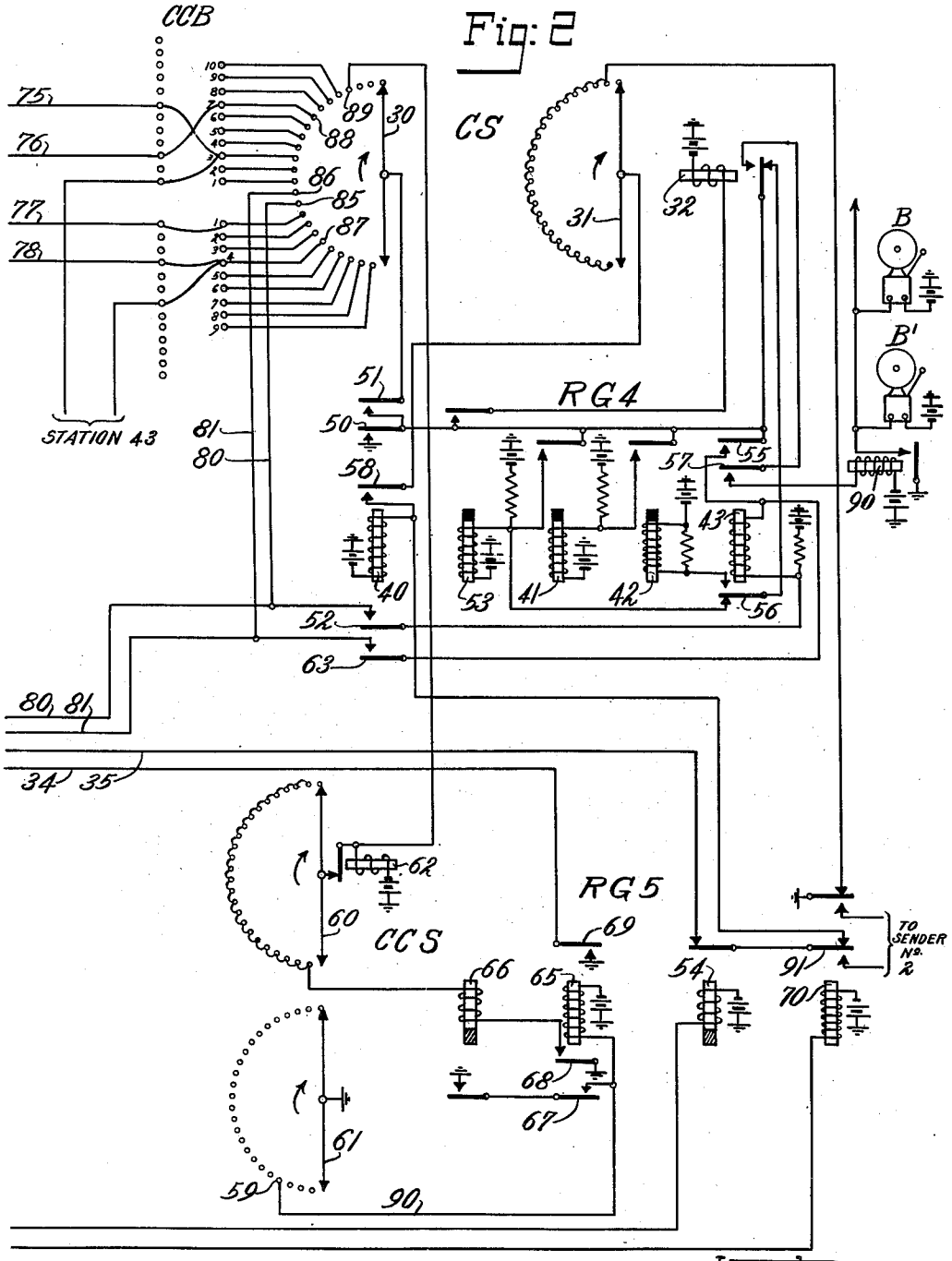
Wm Watts Owen. Atty.

Aug. 16, 1932. C. E. LOMAX 1,871,457

SIGNALING SYSTEM

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Fig: 2



Inventor
Clarence E. Lomax
Wm. Watts Quaw Atty.

Patented Aug. 16, 1932 1,871,457

UNITED STATES PATENT OFFICE

CLARENCE E. LOMAX, OF OAK PARK, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO ASSOCIATED ELECTRIC LABORATORIES, INC., OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE

SIGNALING SYSTEM

Application filed March 11, 1927. Serial No. 174,449.

The present invention relates in general to signalling 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 general character of that disclosed in the prior Lomax Patent No. 1,846,218, granted February 23, 1932, and on which this application is a direct improvement.

The features of improvement over the above patent are, first, to provide equipment for enabling alarms to be turned in from all stations simultaneously, causing individual station equipment to immediately give a signal indicating that an alarm has been turned in and for causing the code of each respective station to be transmitted, but preventing more than one code being transmitted at the same time; second, to enable alarms to be turned in even though the line between the supervisory station and the alarm equipment or fire box is short circuited; third, to arrange for a number of alarm boxes, when operated, to cause the transmission of the same code; fourth, to provide supervisory testing equipment which enables a supervisor to simultaneously test all lines for trouble without causing the transmission of a code and for causing the transmission of a code of any line individually.

The foregoing objects and others not specifically mentioned are attained by the equipment disclosed in the accompanying drawings comprising Fig. 1 and Fig. 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 are shown three fire alarm stations or boxes designated as No. 13, No. 13' and No. 47, respectively, and each contains the equipment included within the dotted rectangle. These stations or boxes are 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 supevisory station each line terminates in a relay group individual to it, for instance, the relay group RG2 is individual to the line terminating in fire alarm box No. 47.

In certain cases it is desirable to have more than one alarm box located on a floor and to have each of the boxes on the same floor to cause the transmission of the same code irrespective of which box is operated. In order to take care of this contingency a relay group RG1, similar to the relay group RG2, instead of terminating directly in a pair of conductors extending to an alarm box, connects with an auxiliary group RG3 from which extend pairs of conductors terminating in the ordinary or standard type of alarm box as shown at station No. 47.

At the lower right hand corner of Fig. 1 is a relay 25 which is termed an open main relay and is common to all lines of the system. The purpose of this relay will be explained subsequently.

At the lower left hand corner of Fig. 1 and included within a dotted rectangle is shown the supervisory and testing equipment. This equipment 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 and RG2. One of these lamps is for giving a trouble indication, while the other is an indication 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 consists in the main of a code sender switch CS, the relay group RG4, which controls the function and operation of the code sender switch, and of a code cut-off switch CCS which determines the number of times the code will be transmitted before the same is cut-off. A pair of ordinary bells B and B1 are indicated as the signalling 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 for 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 box No. 47 and, therefore, breaks the glass in the face of the fire box to send in an alarm. The breaking of the glass releases spring 15 and permits it to assume an alternate position in connection with its grounded back contact and also cuts in the resistance X3 in the series circuit of relays 5′ and 15′.

This circuit ordinarily extends from battery, winding of relay 15′, line conductor 1, through normally closed contacts 15, line conductor 2, through normally closed contacts of key K′ of the supervisory equipment, winding of relay 5′, and through the normally closed contacts of key K3 to ground.

The winding of relay 15′ is quite high compared to that of relay 5′ and, therefore, when the resistance X3 is inserted in series with these relays the current flow is reduced sufficiently to cause relay 5′ to restore, while 15′ remains energized. Relay 5′ at its grounded armature and resting contact completes a circuit for the lamp signal F47 causing it to glow and indicate that an alarm has been turned in from this station.

Ground is also transmitted from the back contact of relay 5′ over the armature and resting contact of relay 17′ 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 armature, 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 16′, its working contact, armature 8′ and its working contact, winding of relay 6′, and armature 14 and resting contact of the open main relay 25 to battery and ground. Relay 6′ operates and completes a locking circuit for itself and an energizing circuit for the open main relay 25 as follows: Grounded armature and resting contact of relay 5′, armature and resting contact of relay 17′, armature 13 and working contact of relay 6′, holding winding of relay 6′ and the winding of relay 25 to battery and ground.

Relay 25 upon operating, at its armature 14 removes battery from the energizing winding of relay 6′ and at its armature 18 and its working contact applies ground to conductor 35 to start the code switch CS. This ground extends over the conductor 35 through the resting contact and armature of relay 54, armature and resting contact 91 of relay 70, and the winding of relay 40 to battery and ground.

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 40 operates. This relay at its armature 51 closes a point in the circuit of the code pick-up wiper 30, at its armature 58 prepares a locking circuit for itself through the wiper 31 which becomes associated with the grounded contacts of its bank as soon as the code switch moves off-normal, at its armatures 52 and 63 closes points in the circuit of the code control relay 43 and at its armature 50 completes an operating circuit for energizing the slow release relay 53. The circuit of this relay extends via grounded working contact and armature 50, armature and resting contact of the motor magnet 32 of the code switch, armature 56 and resting contact of relay 43 and the winding of relay 53 to battery.

Relay 53 upon operating completes a circuit for the motor magnet 32, causing it to energize and break the previously described circuit for slow release relay 53. This relay an instant later restores and opens the energizing circuit of magnet 32 causing the switch to advance one step. The restoration of magnet 32 causes the circuit of relay 53 to be again completed and it will be seen from this that the motor magnet 32 will cause the associated wipers 30 and 31 to be advanced due to the inter-action between the motor magnet 32 and the slow release relay 53 This inter-action continues until the wiper 30 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 number is 4, and is designated as contact 87 in the bank of the code sender.

When the wiper 30 encounters the bank contact 87 ground is transmitted from the grounded contact and armature 50 and armature 51 of relay 40, through wiper 30, bank contact 87, the associated jumper of the cross connecting block, conductor 78, armature 19 and its front contact, conductor 28, conductor 81, working contact and armature 63 of the code switch starting relay 40, the winding of code control relay 43 and the associated resistance in series to battery. The relay 43 upon operating, at its armature 57 connects up the code signal relay 90 with the working contact of the motor magnet 32 so that each time the motor magnet 32 operates, relay 90 will operate to send out a portion of the selected code. Relay 43 also at its armature 56 breaks the initial operating circuit of slow release relay 53 and completes the circuit for slow release relay 42. Relay 42 in turn completes a circuit for slow release relay 41 which, in turn, completes a circuit for the slow release relay 53. The purpose of introducing the additional relays 41 and 42 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 32 can be broken all three of the relays 42, 41 and 53 must be restored. The delay in introducing the relays 41 and 42 into the controlling cir-

cuit 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 motor magnet 32 and the relays 42, 41 and 53 continues until the wiper 30 arrives at its bank contact 85, at which time the relay 90 will have been operated four times. When this occurs ground is transmitted from the wiper 30 via the conductor 80, working contact and armature 52 and the winding of relay 43. This ground shunts battery from relay 43 causing it to restore to disconnect the alarm control relay 90 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 30 arrives at its bank contact 86 ground is transmitted by way of the conductor 81, working contact and armature 63 to the other terminal of relay 43 so that the same is again energized to permit the transmission of the second digit of the code. In the example under consideration when the wiper 30 arrives at contact 88 seven impulses have been transmitted to relay 90 and a circuit is completed for restoring the code control relay 43 as follows: Grounded wiper 30, bank contact 88 through the jumper of the cross connecting block, conductor 76, armature 24 and its working contact, conductor 29, conductor 80, working contact and armature 52 to the resistance associated with relay 43 and to relay 43 causing this relay to be shunted out as before.

As soon as the wiper 30 arrives at the contact 89 an impulse is transmitted to the motor magnet 62 of the code cut-off switch CCS, which advances its wipers 60 and 61 as soon as the wiper 30 leaves the contact 89.

The relay group RG4 of the code sending switch and the code sending switch itself are in the same position now as when the relay 40 was first energized and, therefore, the code switch is again controlled to retransmit the code previously transmitted. By the transmission of each code the foregoing described circuit for the motor magnet 62 of the code cut-off switch is operated and, after the particular code has been repeated a number of times corresponding to the number of steps required for the wiper 61 of the code cut-off switch to encounter its bank contact 59 the circuit is completed for relay 65. Relay 65 upon operating, at its armature 68 connects ground to the bank contacts of the wiper 60 through the winding of slow release relay 66. This latter relay completes a locking circuit at armature 67 for relay 65 which is maintained as long as wiper 60 finds ground. The motor magnet 62 now interrupts its own circuit and is advanced to its normal position as shown, and relay 66 then restores and opens the locking circuit of 65 which also restores.

Coming back to what takes place when relay 65 operates, this relay in addition to closing the restoring circuit of the code cut-off switch and causing its restoration, at its armature 69 connects ground to the conductor 34 which in turn is at this time connected to the winding of relay 17′ by way of the conductor 33 and the armature and working contact of relay 6′. The relay 17′ now operates, at its armature and back contact opens the circuits of relay 16′, the locking circuit of relay 6′ and the circuit of open main relay 25, and at its front contact completes a locking circuit for itself. Due precaution is taken to insure relay 17′ being locked up through its armature and working contact before its energizing circuit is broken by the restoration of relay 6′, this being readily accomplished by proper adjustment of the effected armatures. 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 15 at station 47 is restored to normal, relay 5′ is again energized and disconnects ground from the locking circuit of relay 17′. This latter relay therefore also restores.

Relays 16′ and 25 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 this is the case open main relay 25 again operates over a similar circuit to that provided for it by the relay group RG2, 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 battery being removed from all relays following it corresponding to the relay 6′. Since only one relay corresponding to 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 or 16′ is operated all other corresponding relays, although operable, are rendered ineffective until the code in progress of transmission has been disposed of. This however does not in any way prevent the individual line signal corresponding to F47 from 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.

We will assume now that after the alarm was turned in from station 47 and before the code sender completed transmitting the code corresponding to this station, a second alarm is turned in from station 13. When this occurs the resistance X is inserted in circuit with the relays 21 and 20 which correspond to the relays 5′ and 15′ of the relay group RG2. Accordingly the relay 20 restores and at its armature and back contact

completes a circuit for relay 15^3 which, upon operating, cuts the resistance X^2 into the series circuit including relays 15^2 and 5, causing them to function in the same manner as 5′ and 15′ functioned when the resistance X^3 was inserted in series with them. The relay 5 upon restoring, applies ground to its associated conductor causing the lamp F13 at the supervisor's position to be lighted to indicate that an alarm has been turned in from one of the stations 13 or 13′. This ground also causes the operation of relay 16, but since the relay 16′ has removed ground from the chain circuit the operation of relay 16 is without effect, until after the relay 16′ has restored following the transmission of the code corresponding to station 47. As soon as relay 16′ restores the code sending equipment is controlled to transmit the code 13 in substantially the same manner as it was controlled to transmit the code number 47.

Had the last described alarm been turned in from station 13′ the relay 22 instead of the relay 20 would have restored to effect the operation of relay 15^3. Otherwise the operation would have been identical to the operation effected by the turning in of the alarm from station 13.

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 on the resistance X^3 to cause it to restore, but instead this relay will be short circuited by ground supplied to it from the alternate contact of spring 15 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 the giving of the usual visual alarm for the station which is defective, at its armature 8′ will open its own branch of the chain circuit and thereby prevent the transmission of the code and at its armature 7′ and its resting contact will close the circuit for the trouble lamp T47 individual to that station, so that the supervisor will be advised that there is a case of trouble.

It may be stated that the grounding of the line at the station in addition to the inclusion of the resistance X is an added precaution relied upon to insure that an alarm will be turned in under certain conditions. In case there is a failure of ground the inclusion of the resistance X will be effective to transmit an alarm, while if the lines become accidently short-circuited the ground at the station will result in the deenergization of relay 5′ and the transmission of an alarm. If only the ground was provided at the station and not the resistance, and the relays 5′ and 15′ energized over the line including contacts 15, then there would be no supervision provided for the line, and in this case should the connection extending from the ground to the normally-opened contact become open or the contact itself become corroded or full of dust and dirt, the relay 5′ would not be deenergized when an alarm is turned in over a short-circuited line. Similarly with no resistance at the station and if there is no short circuit then with a failure of ground relay 15′ would deenergize when contacts 15 are opened and indicate an open line condition when the actual trouble is absence of ground at the station.

In fire alarm systems it is poor practice to depend entirely upon a normally opened grounded contact to transmit an alarm signal, because it cannot be relied upon to always be a clean contact and the ground itself is always uncertain. This difficulty has been overcome by having a closed circuit line with a resistance in shunt of normally-closed contacts. The ground connected to one side of the line at the same time the contacts are opened is only an added precaution relied upon to operate the alarm in case the line becomes short-circuited. With the resistance in the line when it is short-circuited it is obvious that the relays 5′ and 15′ would both be held up over the short circuit, but with the ground connected to the line, relay 5′ can deenergize and bring in the alarm in spite of the short circuit.

If the supervisor at any time desires to test the code equipment to see whether it is functioning properly for any particular line she may operate the key K′ individual to the particular line she is doubtful about 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 she desires to test the various trouble and fire lamps to see whether there is any trouble with them or with their circuits, she will simply operate the common key K^3. The operation of this key removes ground from all the relays corresponding to 5′ and 15′ and accordingly the trouble lamps of all stations will light up if they are operative. If however some lamp is burned out or if one of the relays fails to restore the failure of a lamp will advise the supervisor that there is a case of trouble.

If the code sending switch becomes defective the supervisor may operate key K^2 causing the relay 70 to substitute another code sender for the defective one.

From the foregoing it will be appreciated that applicant has designed a fire alarm system which gives a visual alarm the instant an alarm is turned in in all cases irrespective of the number of alarms turned in, at the same time and gives audible alarms of these stations, turning in alarms as fast as the code equipment will permit. It will also be seen that due to the precautions taken against possible trouble on the line effecting the turning in of an alarm and to the equip-

ment provided for testing the lines and the code sending equipment the system should appeal to those desiring the maximum of protection that can be given by a modern fire alarm system.

What is claimed is:

1. In a signalling system, a line comprising two conductors connecting an outgoing station with a central station, signalling equipment at said central station, a pair of contacts at said outlying station normally connecting said conductors into contact with each other, a pair of relays one being marginal and a source of current at the central station connected in series with said line conductors and normally energized thereover, means for opening said pair of contacts, a resistance element at the outlying station included in circuit with said conductors upon the opening of said contacts, said marginal relay deenergized responsive to the inclusion of the resistance in the circuit, the other relay maintained energized through the resistance, means responsive to the deenergization of said marginal relay for controlling said signalling equipment, auxiliary means at the outlying station for deenergizing said marginal relay and maintaining the other relay energized in case said line conductors are short circuited, a trouble signal, said other relay deenergized in case said line conductors are open circuited to operate said trouble signal.

2. In a signalling system, a plurality of fire alarm stations, a central station, lines connecting each alarm station with the central station, a pair of relays for each line in which the lines terminate at the central station, means at each alarm station for operating one of said relays when an alarm is turned in, signalling means individual to the line rendered effective responsive to the operation of said one relay, said other relay operated responsive to a break in the line, trouble signalling means operated by said other relay to indicate the break in the line, and other signalling means common to all alarm stations and operated by said one relay to audibly inform a supervisor of the station turning in the alarm.

3. In a code signalling system, a line connecting an outlying station with a central office, a pair of normally closed contacts and a high resistance element in bridge of the line at the station, code signalling equipment at the central office, means for opening said contacts to include said resistance element in the line, means responsive to the opening of said contacts for operating said code signalling equipment, auxiliary means at the station effective even if the line is short circuited elsewhere to cause the code signalling equipment to function in the same manner that it should have functioned under control of said contacts and high resistance element, trouble signalling means at said office prevented from operating by the inclusion of the resistance element when the contacts are opened, said trouble signalling means operated responsive to an open circuit condition on the line.

4. In a closed circuit fire alarm system having a station connected over a line with a central office, a pair of relays in the line at the central office and normally energized thereover, a pair of contacts and a resistance element in the line at the station, means for opening said contacts to include the resistance in the line, one of said relays deenergized responsive to the inclusion of the resistance in the line to turn in an alarm, the other relay maintained energized through the resistance, additional means at the station for short circuiting said one relay to insure its deenergization in case the line is short circuited when an alarm is turned in, the other of said relays deenergized only responsive to an accidental opening of the line, and a trouble signal at the central office operated by said other relay.

5. In an alarm system, a line, a resistance in said line normally short-circuited, a pair of relays normally energized over said line through said short circuit, one of said relays being marginal, means for removing said short circuit to include said resistance in said line, said marginal relay deenergized responsive to the inclusion of said resistance in said line, the other relay maintained energized through said resistance, alarm equipment operated responsive to the deenergization of said marginal relay to transmit an alarm, said other relay deenergized in case of an open circuit in the line, a trouble signal, and means responsive to the deenergization of said other relay for operating said trouble signal and for preventing the operation of said alarm equipment.

6. In an alarm system, a line, a resistance in said line normally short-circuited, a ground connection normally disconnected from said line, a pair of relays normally energized over said line through said short circuit, one of said relays being marginal and connected to ground, means for removing said short circuit from said resistance and connecting said ground to said line said marginal relay deenergized responsive to the inclusion of said resistance and the grounding of said line and the other relay maintained energized through said resistance and ground, said other relay being deenergized responsive to an open circuit in the line, alarm equipment for transmitting alarm signals, a trouble signal, and means responsive to the deenergization of said marginal relay for operating said alarm equipment and responsive to the deenergization of said other relay for operating said trouble signal.

7. In an alarm system, a line, a pair of relays connected to and normally energized

over said line, one of said relays being marginal and connected to ground, a resistance, means on said line for including said resistance in said line said marginal relay deenergized responsive to the inclusion of said resistance in the line, the other relay maintained energized through said resistance, alarm transmitting means responsive to the deenergization of said marginal relay to transmit an alarm, a trouble signal controlled by the other of said relays, said other relay deenergized responsive to the accidental opening of said line to operate said trouble signal, a ground connection on said line and normally disconnected therefrom, said means for including the resistance in the line also operative to connect said ground to said line to insure the deenergization of said marginal relay by short circuiting the same.

In witness whereof, I hereunto subscribe my name this 7th day of March, A. D. 1927.

CLARENCE E. LOMAX.