Dec. 17, 1929. G. C. SNYDERS ET AL 1,740,123

ALARM CIRCUIT SYSTEM

Filed Oct. 19, 1927 2 Sheets-Sheet 1

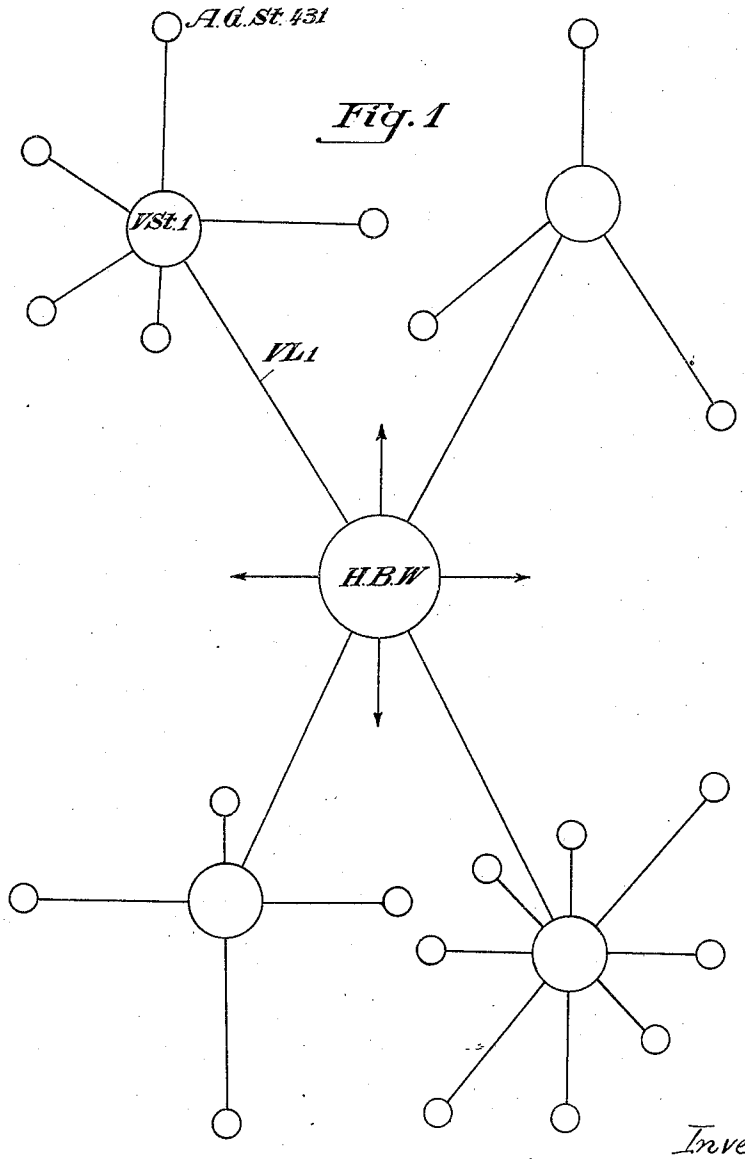

Fig. 1

Inventors:
Gysbertus Cornelis Snyders,
Cornelius Gordyn, Jr.,
Jan van de Kamp,
Charles Edward Adrianus Maitland
by Lowa, Kehlenbeck & Farley
Attorneys.

Dec. 17, 1929. G. C. SNYDERS ET AL 1,740,123

ALARM CIRCUIT SYSTEM

Filed Oct. 19, 1927 2 Sheets-Sheet 2

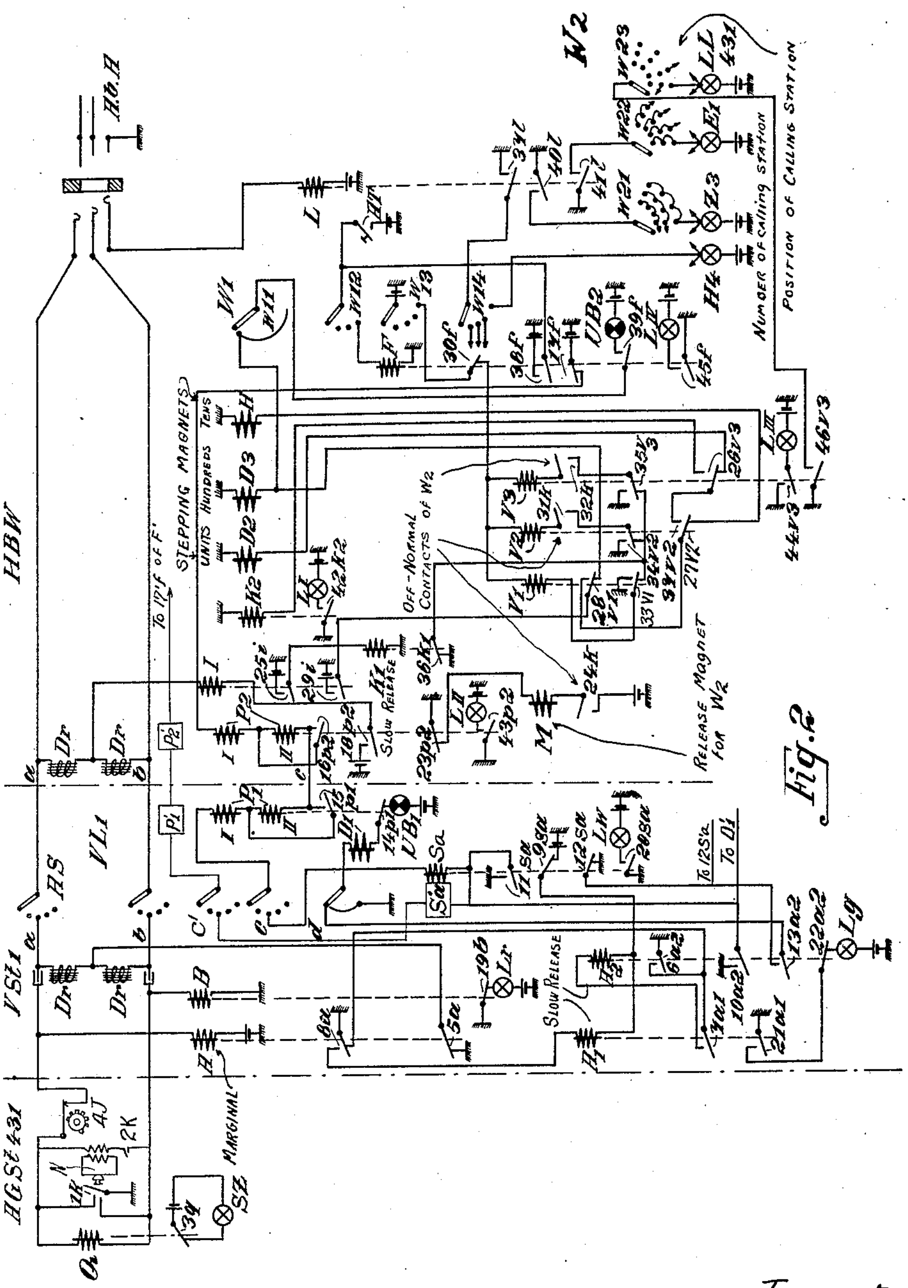

Fig. 2

Inventors:
Gysbertus Cornelis Snyders
Cornelius Gordyn, Jr.
Jan van de Kamp
Charles Edward Adrianus Maitland
by Lowe, Kehlenbeck & Farley
Attorneys

Patented Dec. 17, 1929

1,740,123

UNITED STATES PATENT OFFICE

GYSBERTUS CORNELIS SNYDERS, CORNELIUS GORDYN, JR., JAN VAN DE KAMP, AND CHARLES EDWARD ADRIANUS MAITLAND, OF AMSTERDAM, NETHERLANDS

ALARM-CIRCUIT SYSTEM

Application filed October 19, 1927, Serial No. 227,150, and in Germany April 26, 1926.

Our invention relates to improvements in alarm circuit systems and is intended more particularly for alarm installations with a large number of alarm sending stations, for instance fire alarm plants in large cities.

It has already been proposed, for instance in Patent No. 697,065, to subdivide the alarm sending stations of extensive systems into a plurality of districts and to provide a distributing station for each district. In these distributing stations the lines arriving from the sending stations of a district are collected and in one or a plurality of bunches passed on to the central alarm receiving station. In this system or arrangement the danger arises, that in the event of breakdowns of lines between the distributing stations and the alarm receiving station the reception of an alarm might be prevented although parallel lines are disengaged and free from defects.

The principal object of our invention is to eliminate this drawback. We attain this end in view by providing at the distributing stations automatic means adapted to connect the line of an alarm sending station with a disengaged trunk line leading to the alarm receiving station.

Another object of our invention is to supply means whereby any number of trunk lines may be provided between the distributing stations in the districts and the receiving station.

For economical reasons, however, the number of trunk lines between the distributing stations and the alarm receiving station should preferably be less than the number of the alarm sending stations connected with the distributing stations. The service reliability of the alarm plant is not reduced thereby.

A further object of our invention is to connect each alarm sending station with a free trunk line by the automatic means and it appears very unlikely that a call should be sent simultaneously from all alarm sending stations of a district.

As a matter of course the layout may be such that the number of trunk lines between the distributing stations and the alarm receiving stations is equal to the number of the alarm sending stations connected with the distributing stations. The provision of the automatically operating connecting means has the result in this case also that in case of a breakdown of one or a number of trunk lines the transmission of the alarm signal to the alarm receiving station is ensured, which would not be the case in the event of the continuous wiring of the lines of the alarm sending stations to the trunk lines to the alarm receiving station.

The drawings annexed hereto illustrate an embodiment of our invention by way of example.

Fig. 1 is a diagram of the system of an alarm plant, and

Fig. 2 shows diagrammatically the manner of operation of the means provided at the distributing stations and the central signal receiving station.

Like parts are indicated by like letters of reference in both figures of the drawings.

Signaling boxes 4J, for example those known in the art as sector boxes, which may be wound and which will set in motion a signal wheel when released, may be utilized at the various sending stations.

The selectors W1 and W2 shown in Figure 2, are intended to indicate a calling alarm giving station, for instance the alarm giving station AGS*t*431, at the alarm receiving station HBW. The selector W1 with the switch arms *w*11, *w*12, *w*13 and *w*14 is a step by step switch gear of the well known construction. The switch arm *w*14 controls the circuits of the several hundreds lamps of the alarm giving stations. The selector W2 is a lifting-rotating selector of the Strowger type. The switch arm *w*21 controls the circuit of

the tens lamps, and the switch arm *w*22 the circuit of the unit lamps of the alarm giving stations. In the case of a call from an alarm giving station, the switch arm *w*23 will cause the lighting of a lamp which indicates to the official at the alarm receiving station HBW, in which district the calling alarm station is situated. The selectors W1 and W2 are individually allotted to the connection line constituted by the conductors *a*, *b* and *c* so that there is a separate pair of selectors W1 and W2 for each trunk line from the distributing station to the central alarm station. It is apparent that any individual selector W1 will only have to respond to calls from a single distributing station. The distributing stations may be considered to have numbers, the station VST1 in this case being number 4 or in zone 4. Therefore when any call comes in to W2, the hundreds digit has already been effective in picking out the selector W1 corresponding to zone 4 and also in stepping arm *w*13 to the fourth position, through which contact, W2 is energized for the remaining two digits and so a selector W2 is picked out which corresponds to zone 4. When the other two digits are sent, they serve to properly position *w*21, *w*22 and *w*23 to give the necessary number and location of the calling station.

The lamps H4, Z3 and E1 are arranged in a single bank and are used jointly by all the selectors and all the alarm sending stations. Should two or more calls be sent in simultaneously there will be no interference one with the other for each will operate separate selectors W1 and W2 and the operator can then answer first one and then the other by inserting his telephone set A*b*A into the jack indicated by the lamps LII and LIII which will, as explained more in detail later, operate relay L to close the circuits to the lamp bank. The operation of the system will now be described in detail. In the circuit diagram Fig. 2 all relays are shown in deenergized condition. In this position a current flows from the distributing station VS*t*1 to the alarm transmitting station AGS*t*431 as follows: earth, battery, relay A, current impulse contact 4J, relay Q, relay B, earth. In this circuit only the relay B and the relay Q are excited. The relay A does not respond as yet on account of the high-ohmic relay Q.

At each alarm giving station there is an apparatus (impulse sender) of any suitable construction (shown diagrammatically in Fig. 2 at 4J). By this apparatus the contacts 1*k*, 2*k* and 4J are operated in any appropriate manner. Before transmitting of impulses by contact 4J begins the contacts 1*k* and 2*k* are already operated.

If now the calling apparatus is operated at the alarm transmitting station AGS*t*431 which by the emission of a predetermined number of current impulses transmits to the alarm receiving station HBW the number appertaining to this transmitting station (in our example the No. 431), the contacts 1*k*, 2*k* are operated. By the operaton of the contact 1*k* the above described supervisory closed circuit of the alarm transmitting station AGS*t*431 is altered, the relay Q switched off, the relay B short circuited and the relay A directly connected to earth. The relay B which was energized in the normal condition of the plant is deenergized and lights up the lamp LR at the distributing station VS*t*1 by means of back contact 19*b*. The fact that the relay Q falls back effects the switching in of a visible signal SZ at the alarm transmitting station 431. The relay A which in the before described supervisory closed circuit was not excited due to the high resistance of the relay Q, is now excited along the following path: earth, contact 1*k*, *a*-conductor, contact 4J, relay A, battery, earth. By closing the contact 2*k* the speaking apparatus N of the alarm transmitting station is connected into the trunk.

Upon the operation of the relay A a circuit for the relay A1 is closed: earth, front contact 8*a*, relay A1, back contact 9*sa*, battery, earth. The relay A1 closes its contact 7*a*1 and prepares a circuit for the relay A2. From the alarm transmitting station AGS*t*431 the first current impulse series (in our example the number 4), is now sent by the current impulse contact 4J. After the emission of the first current impulse the relay A becomes deenergized and the relay A2 is excited by a current taking the following path; earth, back contact 8*a*, front contact 7*a*1, relay A2, back contact 9*sa*, battery, earth. The relays A1 and A2 are slow-release relays and consequently remain excited during the sending of current impulses by the relay A. With its contact 6*a*2 the relay A2 closes a holding circuit for itself independently of relay A; earth, front contact 6*a*2, front contact 7*a*1, relay A2, back contact 9*sa*, battery, earth.

If the relay A is excited due to a breakdown, for instance, by a short-circuit of the *a*-conductor, the contact 8*a* is operated and remains in its operative state. The excitation of the relay A2 and a transmission of switching operations to the alarm receiving station HBW is prevented thereby. In the event of a breakdown only the relay A1 of the two relays A1 and A2 thus is operated and by the contact 21*a*1 a lamp L*g* is made to light up reporting the breakdown which has developed at the distributing station VS*t*. The circuit for the lamp L*g* is as follows: earth, front contact 21*a*1, back contact 22*a*2, lamp L*g*, battery, earth. Due to the earth connection the relay B will also become dead and will light up the lamp L*r*. An earth connection at the *b*-conductor causes the deenergizing of the relay B and the lighting up of the lamp L*r*. A short circuit between both con-

ductors causes a direct closing of the *ab*-loop. In that case the relay A and the relay B are excited, and the relay A brings about the operation of the relay A1, whereby the lamp L*g* is operated.

If, on the other hand, no breakdown has developed, but an alarm signal is sent from the alarm transmitting station AGS*t*431 across the current impulse contact 4J so that after the sending of the first current impulse the relay A is again deenergized, the relay A2 is ready to be energized. The relay A2 opens its back contact 22*a*2 and thereby prevents a lighting up of the lamp L*g*. Across its front contact 10*a*2 it prepares the test circuit across the *c*-conductor and with its contact 13*a*2 it closes the circuit for the rotary magnet D1 of the line finder AS: earth, back contact 12*sa*, front contact 13*a*2, *d*-conductor, *b*-wiper of the line-finder, position O, rotary magnet D1, back contact 14*p*1, automatic circuit-breaker UB1, battery, earth. If the rotary magnet D1 has operated the line finder AS by one step, it is excited in the following manner: earth, *d*-wiper of the line finder AS, rotary magnet D1, back contact 14*p*1, automatic circuit-breaker UB1, battery, earth. The line finder AS is thus intermittently stepped forward until it has found the calling alarm transmitting station AGS*t*431. In this position it closes the test circuit across the *c*-conductor: earth, front contact 10*a*2, relay S*a*, *c*-conductor, *c*-wiper of the line finder AS, windings I and II of the test relay P1, *c*-conductor of the trunk line VL1, windings II and I of the test relay P2, back contact 17*f*, battery, earth. The windings II of the test relays P2 and P1 are short-circuited by the contacts 15*p*1 and 16*p*2 and thus the trunk line VL1 is blocked against a call from another alarm giving station in a manner to be described more in detail hereafter. The contact 14*p*1 interrupts simultaneously the circuit for the rotary magnet D1 of the line finder whereby the latter is rendered inoperative. With its contact 11*sa* the relay S*a* closes a holding circuit for the test line.

The alarm giving station AGS*t*431 is connected in multiple connection to a number of call finders. This arrangement is not fully shown in Figure 2. If for instance when the alarm giving station AGS*t*431 is calling, the call finder AS shown in Figure 2 is already engaged, the circuit for the rotating magnet D1 of the call finder AS will be opened by the contact 14*p*1, and the call finder AS cannot be started. A free or disengaged call finder to which is also connected the alarm giving station AGS*t*431, starts and searches for the calling alarm giving station.

If the connection line starting from the call finder, AS, leading from the distributing station VS*t*1 to the alarm receiving station HBW and constituted by the conductors *a*, *b* and *c*, should become defective, the call finder AS will not be able to find a calling alarm giving station and connect it to the defective connection line because the line *c* will be broken and therefore relays P1 and P2 will not energize.

If the call finder AS has found for instance the calling alarm giving station AGS*t*431 and connected it to the connection line leading to the alarm receiving station HBW, the high resistance windings II of the testing relays P1 and P2 will be short circuited in the well known manner. The result of this short circuit will be that no further call finders connected in parallel to the call finder AS, will be able to become switched on to the same connection line of the alarm giving station AGS*t*431. The testing relays of the remaining call finders cannot be excited when they contact with a line already in use because they include the high resistance coils II which will be placed in parallel with low resistance coils I of the test relay already in use. There is not sufficient voltage drop across the coils I to operate the marginal coils II. This second line finder is shown as comprising the line *c'* and relays P1' and P2' which are identical with relays P1 and P2. The line continues to the corresponding terminal 17'*f* of a second relay F' and through battery to ground, thus making the relays P1 and P2 in parallel with P1' and P2' when two call finders contact with the same sending station. For a full disclosure of this operation of blocking a trunk line, reference may be had to German Patent 300,949.

The drawing shows completely the apparatus for only one call finder AS but it will be understood that the call finders associated with all the trunk lines are multipled and all are set into operation when any calling sending station sends out its first conditioning impulse. The contacts 10A2 of relay A2 close a circuit through relay S*a* and the line over which the signal ultimately will be sent as well as a circuit for all the other relays S'*a* of the other trunk lines *c'*. Likewise, contacts 13*a*2 of relay A2 close a circuit for the rotary magnet D1 as well as for all the other magnets D1' of the trunk lines *c'*. These rotary magnets D1' will continue to operate the call finders not in use as long as relay A2 is energized and will only stop when that relay is deenergized or when they come in contact with a calling sending station. The call finders may be returned to normal position by the deenergization of the relay P1 which closes a self-interrupting circuit for stepping magnet D1 through the bank of contacts *d*.

The relay P2 opens by means of its contact 23*p*2 the exciter circuit for the release magnet M of the rotary selector W2 at the alarm receiving station HBW. By closing the contact 43*p*2 the lamp LII is made to light up and indicates at the alarm receiving station that an alarm transmitting station has been con-

nected with it. The relay P2 closes with its contact 18*p*2 the exciting circuit for the impulse relay of the alarm receiving station: earth, back contact 5*a*, inductive coils D*r*, *a*- and *b*-wiper of the line finder AS, *a*- and *b*-conductors of the trunk VL1, inductive coils D*r*, current impulse relay I, front contact 18*p*2, battery, earth. The inductive coils D*r* merely serve to establish a speaking communication between the operator of the alarm receiving station HBW and the alarm transmitting station AGS*t*431. The contact 5*a* transmits the current impulses sent from the alarm transmitting station to the relay I. The relay A at the distributing station VS*t*1 follows the current impulses emitted by the alarm transmitting station and by opening and closing of the contact 5*a* the current impulse is transmitted to the relay I at the alarm receiving station HBW. By the closing of contact 25*i* the relay K1, constructed as a slow-release relay, is excited across: earth, relay K1, front contact 25*i*, battery, earth. The relay K1 remains excited during the sending of a series of current impulses and opens its contact 36*k*1, so that the relays V1, V2 and V3 are unable to become energized during this time. By means of its contact 29*i* the relay I transmits the current impulses received to the rotary magnet D3 of the selector W1: earth, rotary magnet D3, back contact 28*v*1, front contact 29*i*, battery, earth. After the first impulse series is finished the relay K1 becomes deenergized and closes with its back contact 36*k*1 a circuit of the relay V1: earth, back contact 36*k*1, back contact 33*v*1, relay V1, back contact 30*f*, wiper *w*13 of the selector W1, battery, earth.

The rotary magnet D3 has after its first impulse series (in our example consisting of four current impulses) stepped the selector W1 up the predetermined (in our example the fourth) hundreds lamp H4 across its wiper W14. The wipers of the selector W, as well as those of the finder switches, are preferably of the double arm variety.

By its contact 33*v*1 the relay V1 has closed a holding circuit for itself, by its contact 28*v*1 it deenergizes the rotary magnet D3 and operates the vertical magnet H. When sending the second current impulse series the relay K1 is reexcited and opens its contact 36*k*1. The vertical magnet H is consequently excited by the following circuit: earth, magnet H, back contact 27*v*2 front contact 28*v*1, current impulse contact 29*i*, battery, earth. The vertical magnet raises the selector W2 into the desired decade, for instance the third decade. As soon as the selector W2 is operated from its normal position of rest, the off normal contacts 24K, 31K and 32K are closed, preparing circuits for relays M, V2 and V3 respectively.

After the second series of current impulses has been sent the relay K1 falls back again and closes, and since the selector W2 is raised out of its inoperative position and consequently the contact 31*k* is closed, a circuit for the relay V2 is completed: earth, contact 36*k*1, contact 34*v*2, contact 31*k*, relay V2, contact 30*f*, wiper *w*13 of the selector W1, battery, earth. The relay V2 closes with its contact 34*v*2 a holding circuit for itself and with its contact 27*v*2 it deenergizes the vertical magnet and operates the rotary magnet. During the sending of the third series of current impulses the relay K1 is excited again and thus the contact 36*k*1 opened. The third series of current impulses now transmits itself to the rotary magnet D2 along the following circuit: earth, magnet D2, back contact 26*v*3, front contact 27V2, front contact 28*v*1, current impulse contact 29*i*, battery, earth. In correspondence with the series of current impulses the rotary magnet D2 turns the selector W2 into the stepped decade. Since the relay K1 is deenergized again after the third series of current impulses is finished and the selector W2 has been turned into the correct position, the relay V3 is now excited across the off normal spring 32*k*: earth, back contact 36*k*1, back contact 35*v*3, off normal spring 32*k*, relay V3, contact of rest 30*f*, wiper *w*13 of the selector W1, battery, earth. The relay V3 produces a holding circuit for itself by closing its contact 35*v*3, with its contact 26*v*3 it deenergizes the rotary magnet D2 of the selector W2 and prepares a circuit for the relay K2.

By its contact 44*v*3 the relay V3 closes a circuit for the lamp LIII, the lighting up of which indicates to the operator at the alarm receiving station that the transmission of the alarm is finished.

The contacts of the wiper *w*23 of the selector W2 are connected with a lamp panel, which represents a plan of the entire layout and indicates to the operator at the central alarm station from which point of the city the call has been sent. By closing the contact 46*v*3 this lamp is lighted up, since the selector W2 is stepped up a definite lamp LL431, and the alarm transmitting station unequivocally indicated.

If after the sending of an alarm from the alarm transmitting station AGS*t*431 this transmitting station is returned again into the inoperative state, before the operator of the receiving station has been able to get into communication with it by means of his telephone A*b*A, the contact 5*a* is closed due to the deenergizing of the relay A at the distributing station VS*t*1 and the relay I is excited. The circuit for the relay K2 is consequently closed: earth, relay K2, front contact 26*v*3, front contact 27*v*2, front contact 28*v*1, front contact 29*l*, battery, earth. By the closing of its contact 42*k*2 the relay K2 causes the lamp LI to light up and indicates

to the operator at the alarm receiving station that after the sending of the alarm signal this alarm station has been abandoned again.

For the purpose of getting into communication with the connected alarm transmitting station the operator at the alarm receiving station inserts the plug of his calling up apparatus A*b*A into the jack, whereby the relay L is excited: earth, plug jack, relay L, battery, earth. The relay L effects the closing of its contacts 37*l*, 40*l* and 41*l* whereby the circuits for the lamps H4, Z3 and E1 are closed and the number of the connected alarm transmitting station 431 appears in the lamp panel.

After the operator at the alarm receiving station has noted the report, he depresses the release key AT. The relay F is then excited along the following circuit: earth, relay F, wiper *w*12 of the selector W1, release key AT, battery, earth. With its contact 38*f* the relay closes a holding circuit for itself. By opening the contact 30*f* the relays V1, V2 and V3 are deenergized. By the contact 39*f* the rotary magnet D3 is connected with the automatic circuit-breaker UB2 which turns the selector W1 intermittently forward into the position of rest across the following circuit: earth, rotary magnet D3, wiper *w*11 of the selector W1, front contact 39*f*, automatic circuit-breaker UB2, battery, earth. By opening the contact 17*f* the test current passing across the connecting line VL1 is broken and the relays S*a*, P1 and P2 deenergizing. By the deenergization of the relay P2 the release magnet M of the selector W2 is energized in across the back contact 23*p*2 which returns the selector into the position of rest. By closing the contact 45*f* the lamp LIV is made to light up which for the operator at the alarm receiving station serves as a control or check for the fact, that the selector W1 has been turned back into the position of rest, since when the selector W1 is turned into the position of rest the circuit for the relay F is interrupted and the lamp LIV goes out again.

The selector W2 is so constructed that its wiper *w*21 runs across banks of contacts which are directly connected in the direction of rotation of the selector, while the wiper *w*22 traverses banks of contacts, which are connected through in the vertical direction of the selector. In this way the result is attained that a lamp panel of 3×10 lamps is able to control unequivocally a range of numbers from 1 to 1000.

Various modifications and changes may be made without departing from the spirit and the scope of the invention, and we desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:

1. An alarm circuit system comprising alarm sending stations each having means for transmitting impulses, a distributing station, circuits connecting said sending stations with the distributing station, an alarm receiving station, trunk lines connecting said distributing station with the alarm receiving station, automatic means at said distributing station responsive to the initial operation of said transmitting means for connecting a calling station with a disengaged trunk line leading to the alarm receiving station, and controlling means in said distributing station operated by the said automatic means indicating the connection of a trunk line with the line of an alarm sending station.

2. An alarm circuit system comprising alarm sending stations, a distributing station, a central receiving station, circuits connecting said sending stations with the distributing station, trunk lines connecting the distributing station with the alarm receiving station, means at each sending station for changing the resistance of the circuit connecting the sending station with the distributing station and for thereafter transmitting impulses over said circuit, and means responsive to the change of resistance of said circuit and the transmission of impulses thereover for automatically connecting said circuit to a disengaged trunk line leading to the central station, whereby said means will be nonresponsive to a mere change of the resistance of the circuit due to a defect of the circuit which will either open or short circuit the circuit.

3. An alarm circuit system comprising alarm sending stations each having means for transmitting impulses, a distributing station, circuits connecting said sending stations with the distributing station, an alarm receiving station, trunk lines connecting said distributing station with the alarm receiving station, automatic means at said distributing station responsive to the initial operation of said transmitting means for connecting a calling station with a disengaged trunk line leading to the alarm receiving station, and controlling means at the receiving station operated by the taking of a particular trunk line for use for indicating such trunk line.

4. An alarm circuit system comprising alarm sending stations, a distributing station, a central receiving station, circuits connecting said sending station with the distributing station, trunk lines connecting the distributing station with the alarm receiving station, means at each sending station for changing the resistance of the circuit connecting the sending station with the distributing station and for thereafter transmitting impulses thereover, means responsive to the

change of resistance of said circuit and the transmission of impulses thereover for automatically connecting said circuit to a disengaged trunk line, and manually operative means in the receiving station to establish connection with the sending station through the trunk line taken for use, and indicating means responsive to the restoration of the alarm station circuit to normal for indicating abandonment of the alarm sending station.

In testimony whereof we affix our signatures.

GYSBERTUS CORNELIS SNYDERS.
CORNELIUS GORDYN, Jr.
JAN van de KAMP.
CHARLES EDWARD ADRIANUS MAITLAND.