Dec. 1, 1936. W. T. POWELL 2,062,822

SELECTIVE SIGNALING SYSTEM

Filed Feb. 4, 1933 3 Sheets-Sheet 1

FIG. 1.

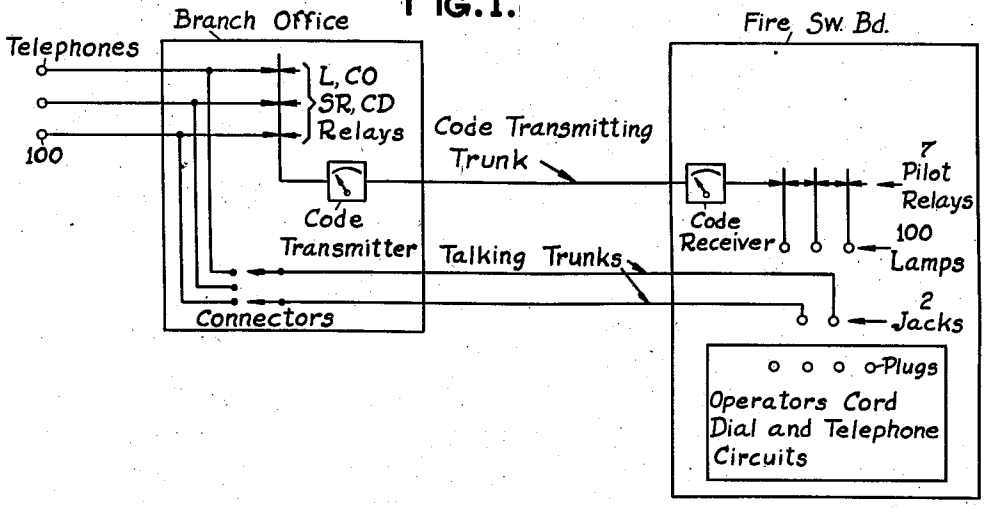


FIG. 4.

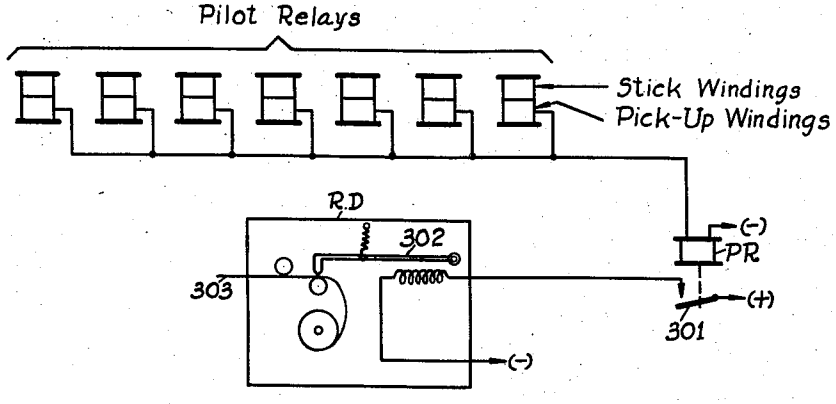
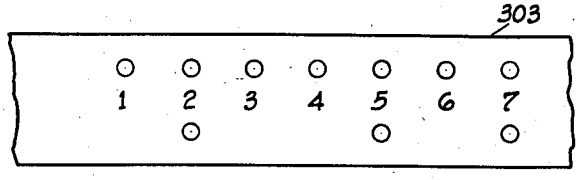


FIG. 5.



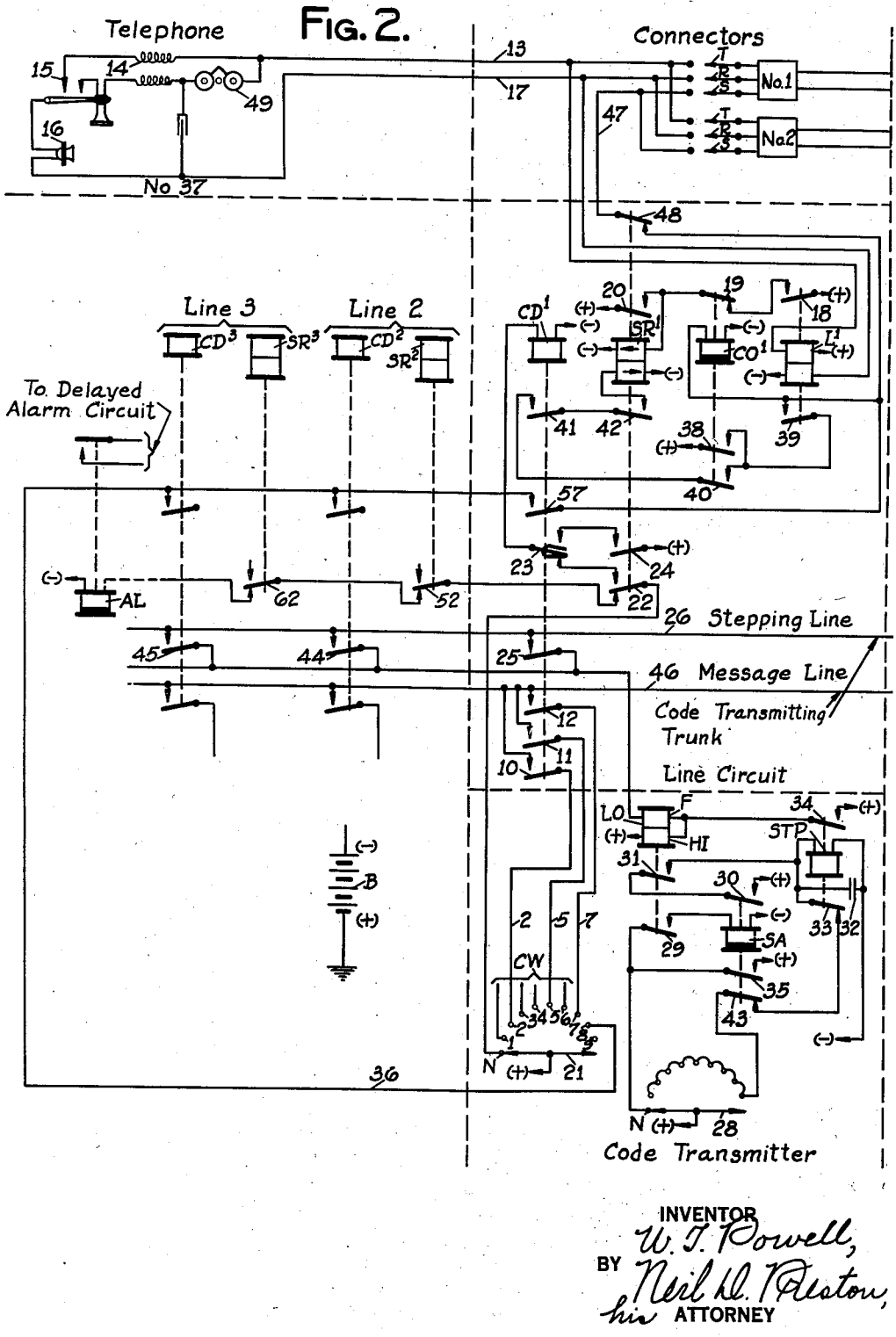
INVENTOR
W. T. Powell,
BY
his Neil H. Alston,
ATTORNEY

Dec. 1, 1936. W. T. POWELL 2,062,822

SELECTIVE SIGNALING SYSTEM

Filed Feb. 4, 1933 3 Sheets-Sheet 2

FIG. 2.



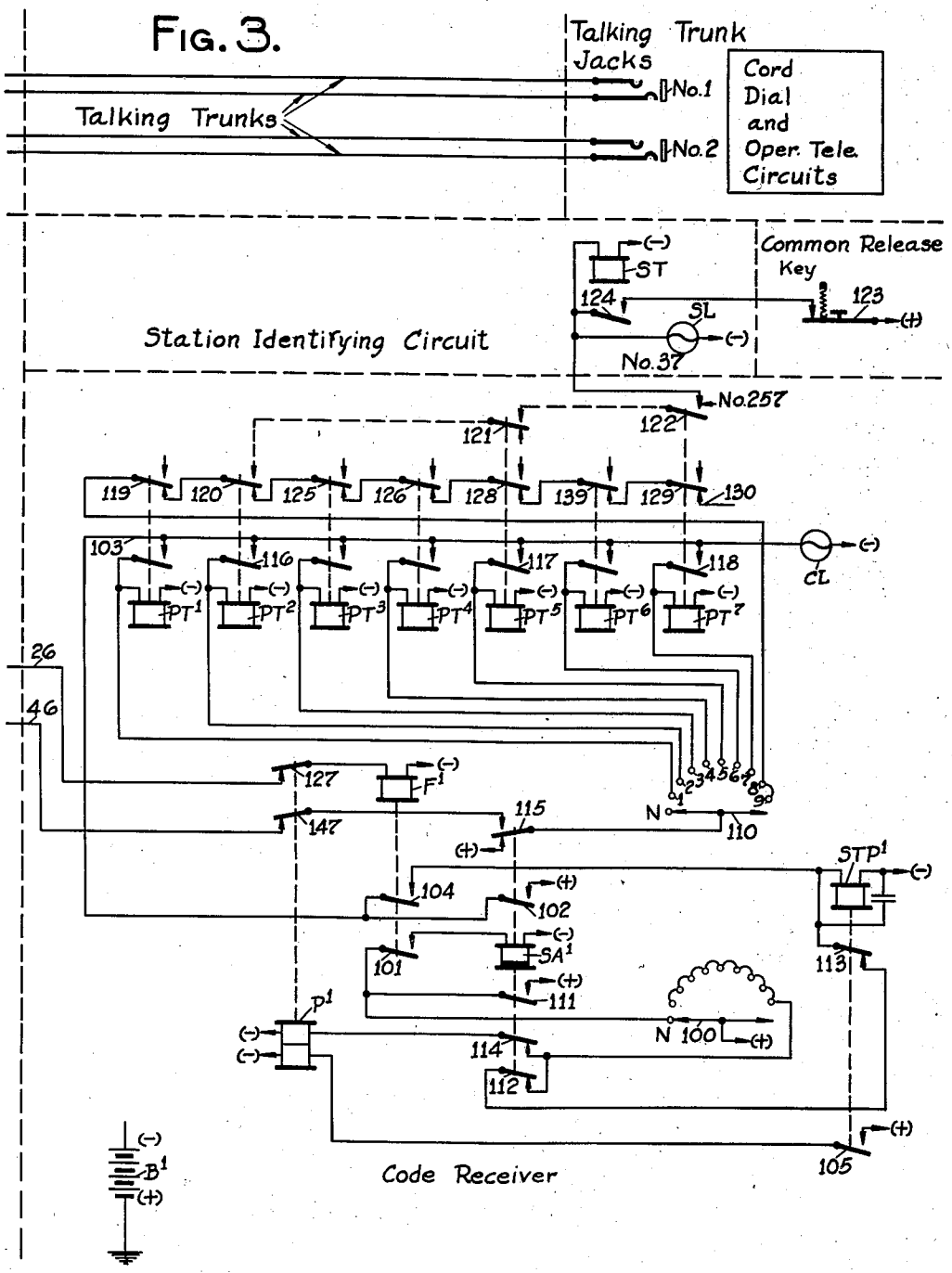
INVENTOR
W. T. Powell,
BY
Neil M. Preston,
his ATTORNEY

Dec. 1, 1936. W. T. POWELL 2,062,822

SELECTIVE SIGNALING SYSTEM

Filed Feb. 4, 1933 3 Sheets-Sheet 3

FIG. 3.



INVENTOR
W. T. Powell,
BY
Neil W. Preston
his ATTORNEY

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UNITED STATES PATENT OFFICE

2,062,822

SELECTIVE SIGNALING SYSTEM

Winfred T. Powell, Rochester, N. Y., assignor to General Railway Signal Company, Rochester, N. Y.

Application February 4, 1933, Serial No. 655,216

26 Claims. (Cl. 179—5)

This invention relates in general to selective signaling systems, more particularly as are used for fire alarm and police box systems and the principal object of the invention, briefly stated, is the provision of improvements in such systems which increase the flexibility and reliability and which reduce the cost.

One form of fire alarm and police box system employs a single wire circuit extending outwardly from a central office through a plurality of alarm boxes and thence back to the office. Such a system makes use of the closed circuit principle and alarms are sent in by the transmission of code impulses originating at the boxes. There are certain objections to this plan of operation, such as interference when simultaneous alarms are turned in, interruption of the complete system due to an open line condition, etc.

Experience indicates that a large percentage of fire alarms are transmitted over the usual telephone system, which is an advantage, in that the party reporting the fire can report the exact location without the need of remaining at the box until the fire apparatus arrives.

The telephone companies have departments for maintaining and clearing trouble on systems of this type, so that it appears to be a matter of economy to transfer it all to their supervision and to make use of their wire plant.

The present invention contemplates a fire alarm and police call system in which ordinary common battery telephones are provided at the boxes, each connected by a two-wire line circuit to the nearest telephone office. These telephone instruments may be so assembled that they can be placed in the existing fire alarm boxes in place of the code sending mechanism, since this mechanism is not employed in the present invention.

The well-known weather proof mine type telephones may be used at the locations and such other expedients may be provided as desired, such as repiacing the telephone hook switch with door contacts and the like.

In the present invention it is proposed to terminate these individual alarm circuits in the nearest telephone office and so organize the system that simultaneous alarms can be transmitted from any number of boxes and recorded at a fire switchboard located at a central office. The circuits are so arranged that the central office attendant or operator can transmit a signal to each box by means of a bell, light or other device. This is useful for calling police to the telephones. Therefore, the present invention may be considered a combined fire and police system.

These characteristic features of the present invention will be explained more in detail in the following description of one embodiment and various other characteristic features, advantages and functions of a system embodying this invention will be in part pointed out and in part apparent as the description progresses.

In describing the invention in detail, reference will be made to the accompanying drawings which illustrate one method of carrying out the invention by way of example. The drawings illustrate in a diagrammatic manner the apparatus and circuits employed. The present disclosure of the layout of the system is merely an example chosen to conveniently describe the operation and is not to be considered an essential arrangement of the invention.

Fig. 1 illustrates in schematic form the general plan or layout of the system.

Figs. 2 and 3 illustrate the apparatus and circuits employed.

Fig. 4 shows diagrammatically one form of recording device for recording the code which identifies the calling station.

Fig. 5 shows a section of the tape used in the recording device with code No. 257 recorded thereon.

The illustrations in the drawings are schematic and abbreviated for the purpose of clearness and simplicity. The arrangement of those parts which are not illustrated in the drawings and their cooperation and connection with the illustrated portions will be set forth in the following general description. A detailed description will be given of the operation of the system after the general description.

General description

It will be assumed that there are one hundred alarm boxes in the district of the branch office illustrated in Fig. 1. These one hundred stations terminate in the telephone office located in that particular section of the city, while the fire operator's switchboard is shown at a centrally located point, assumed to be another telephone exchange. In larger systems where there are additional branch telephone offices, the equipment illustrated in the branch office of Fig. 1 will be provided in the other offices. Likewise, the code receiver, pilot relays, lamps and jacks will be duplicated at the fire switchboard but the operator's equipment will be used in common for any number of offices.

According to the invention, the boxes or stations are numbered, for example, in the decimal notation to correspond to the ten impulses transmitted by the well-known telephone dial. This is of particular advantage in connection with calls from the operator outward to the stations. As indicated in Fig. 1, the one hundred line circuits in each office terminate on line and cut-off relays, L and CO. This drawing indicates that a connection can be made from any one of the lines in each office to the common code transmitting trunk which leads to the so-called fire switch-

board, the storing and code determining relays SR and CD associated with the line circuits being for this purpose. This trunk is used in common to transmit the number of the calling line to be recorded at the fire switchboard.

The line circuits likewise terminate on banks of connecter switches commonly employed in automatic telephone practice. Only a few of these connecter switch trunks are required between the fire switchboard and the outlying telephone office and in the present embodiment disclosed, it is assumed that two such trunks are sufficient.

The operation in general may be described as follows:—Closing the circuit at the telephone at one of the alarm stations causes the code transmitter associated with the common code transmitting trunk, in the office where this line terminates, to make one cycle of operations. The code receiver associated with this trunk in the office where the fire switchboard is located, likewise makes one cycle of operations, stepping in synchronism with the transmitter at the distant end.

During this cycle of operations, a particular code, as determined by the calling station, is transmitted over the code transmitting circuit for lighting one of the one hundred lamps indicated, the particular lamp which lights corresponding to the particular station which is calling.

The number of the calling station is thus identified by means of the number of the lighted lamp. A record may be made, by means of a punch register that this particular line made a call at the particular time indicated on the tape of the register.

The operator inserts the plug of a standard cord circuit into either one of the outgoing trunk jacks associated with the outlying office and by means of the well-known operator's dial, sets up a connection to the calling line by dialing two digits. This is effective to advance the connecter switch associated with the jack used, to bank contacts which are connected to the calling line. The operator then receives and gives the necessary information, after which the connection over the talking trunk is released by the removal of the cord circuit.

The necessary information is passed on to the proper fire station in any approved manner, such as by means of a telephone, a loud speaker or a bell alarm. This information may be passed as soon as the calling station is identified and any additional information may follow after the operator talks to the calling party.

The circuits are so arranged that in the event of simultaneous calls or calls in rapid succession, the stepping switches at each end of the code transmitting trunk operate through successive cycles until all of such calls are indicated and recorded at the fire switchboard.

The symbols (+) and (—) are employed to indicate the positive and negative terminals, respectively of suitable batteries or other sources of direct current and the circuits with which these symbols are used always have current flowing in the same direction. Battery B is in the office where the code transmitter is located and battery B^1 is in the central office where the fire switchboard is located. It is to be understood that these symbols are used to indicate the terminals of separate batteries in the separate offices. The (—) terminals of these batteries at the different offices are not connected together but in each office this symbol indicates a common connection to the battery. The (+) terminals of the two batteries in all the offices are connected together, however, and usually grounded as is common in telephone practice. For this reason a circuit connected to the (+) terminal indicated in one of the offices has a path through ground to the (+) terminal in all of the offices.

For convenience in describing the operation of the system, the two wires of the code transmitting trunk connecting the fire switchboard with the distant telephone office, are referred to as the stepping line and the message line. The stepping line is the line in which the line relays at each end of the circuit, as well as the contacts of the impulsing relay and the code determining relay are connected. The message line is that line over which the code corresponding to the calling station is transmitted.

The detailed circuit arrangements of the connecter switches which are used to connect with the individual lines, as well as the operator's cord circuits and dial circuits at the fire switchboard are not shown in detail since these are commonly employed in telephone systems. Obviously, the connecters may be of the step-by-step switch type or they may be of the relay type, and where there are more than one hundred lines in a group, intervening selectors may be provided.

It will be obvious that the usual busy test feature of the connecter circuit will be omitted, since the connection is to be made to a calling telephone when the receiver is off the hook. The usual automatic ringing circuit may be used for signaling the station, since a connection made to a station with the receiver off will cause the ringing to be immediately tripped. Or the ringing may be controlled by a key at the fire switchboard. Likewise the battery feed portion of the connecter toward the called line is not required since the telephone obtains its current supply from its line relay. The lamp or visual indication at the station has not been shown, since this is a common expedient and may be accomplished in numerous ways.

Equipment

The equipment at each individual alarm station comprises a common battery manual telephone indicated in the upper left hand corner of Fig. 2, which telephone may be housed in any approved manner. The individual station is connected to the branch office by means of a two-wire, normally deenergized line circuit.

Associated with each individual line circuit in the central office, is a group of relays comprising line relay L^1, cut-off relay CO^1, storing relay SR^1 and code determining relay CD^1. These relays are of the neutral type, relay CO^1 being slow releasing by virtue of a copper sleeve over its core, a short circuited winding or the like. Relay L^1 is of the type commonly used in telephone systems for supplying battery feed to the substation circuits and relays SR^1 and CD^1 are likewise telephone type relays.

Immediately to the left of the individual line circuit relays, two similar groups of SR and CD relays (characterized by use of exponents 2 and 3) are shown for the purpose of illustrating the interconnection between line circuits for storing simultaneous calls and allowing only one call to be transmitted at any one time. It will be understood that in a system where there are one hundred stations in a group there will be one hundred groups of these line relay equipments.

The code transmitter is shown directly below the individual line circuit and consists of the well-known rotary line switch mechanism com-

monly employed in telephone systems, together with a line relay F and a slow acting control relay SA. This switch mechanism is of the two brush ten point type as illustrated in the drawing of Fig. 2, but it will be obvious that it may be replaced by a bank of stepping relays, such as is commonly provided in centralized traffic controlling systems for railroads. The rotary switch is illustrated in its normal position and during a cycle of operations it advances its brushes step-by-step in a clockwise direction by means of its stepping magnet STP. The switch is of the type which advances its brushes when the magnet deenergizes rather than when it energizes.

Immediately above the individual line circuit two connecters are indicated, connecting to the talking trunks leading to the fire switchboard. These connecters are illustrated as having access to multiple sets of contacts leading to the line illustrated in this figure. It will be obvious that there will be 99 other sets of similar contacts leading to 99 other line circuits for providing service to the complete group of 100 lines.

In the center of the drawings of Figs. 2 and 3, the code transmitting trunk is indicated. The two wires of this trunk are identified by referring to the upper one as the stepping line and the lower one as the message line.

The code receiver associated with the code transmitting trunk is shown in Fig. 3. This device is located in the central office where the fire switchboard is installed. The code receiver is similar to the code transmitter, in that it consists of a two brush, ten point rotary line switch, the switch itself being an exact duplicate of the code transmitter switch. Line relay F^1 and slow acting relay SA^1 correspond to similar relays at the distant end of the trunk. Impulse relay P^1 is for the purpose of opening the two conductors of the code transmitting trunk for a purpose which will be explained in detail.

The code receiver equipment also includes a bank of station registering or decoding relays, which are responsive to the code calls communicated to the fire switchboard over the message circuit from stations having calls to transmit. Such stations transmit their code combinations and are registered or identified one at a time on this bank of station registering relays. In the particular arrangement shown, this bank of relays comprises a group of pilot relays PT^1, PT^2, PT^3, PT^4, PT^5, PT^6 and PT^7, together with an individual station relay ST.

This arrangement of station registering relays is capable of registering one hundred twenty-eight stations. For each pilot relay added, the number of individual stations which can be registered is doubled and for each pilot relay of the seven shown in this embodiment removed, the number of individual stations which can be registered is reduced one-half.

Station lamp SL shown immediately above relay PT^7 and in association with the station identifying circuit, is for the purpose of visually indicating to the operator the number of a calling station. It will be understood that there will be one of these lamps and its associated relay ST for each individual station in the system. Common lamp CL shown in association with the pilot relays is for the purpose of giving advance information to the operator that a call is coming in. This lamp lights as soon as the code receiver starts to function for a cycle of operations and slightly before the individual station is registered in the office. It will be obvious that this common lamp may be replaced by a single stroke gong as an attention alarm indicating by audible means that a call is coming in.

The common release key shown just to the right of the station identifying circuit is common to a particular group of such circuits and is for the purpose of extinguishing the station lamp after the operator has made a record of the call. In the upper right hand corner of Fig. 3, the two talking trunk jacks which lead to the connecter switches in the branch office are indicated. Co-operating with these jacks is the usual cord, dial and operator's telephone circuits indicated within the full line rectangle.

Referring to the modification of Fig. 4, the same group of seven pilot relays shown in Fig. 2 is indicated as comprising double wound relays. These relays control the station registration in the same manner as those in Fig. 3. They are shown with their pick-up windings (lower) connected in series with a relay PR. The pilot relays are stuck up when operated by means of their upper windings which are independent of their pick-up windings. Relay PR is for the purpose of operating a recording device such as a time recording punch register RD of the well-known type used in fire alarm systems. It will be obvious that a recording device may be operated from relay ST of Fig. 3 for recording calls made from each individual station. With the recording device connected as shown in Fig. 4, only one punching or marking mechanism is required, since it is operated by means of the code impulses received over the message line.

Detailed operation

It is believed that the operation of the system may best be understood by considering the detailed circuit operations effected when the telephone shown in the upper left hand portion of Fig. 2 originates a call. It will be assumed that the decimal system number of the calling station is 37 and that its code number is 257. Lamp SL is numbered **37** since this is the line number which must be dialed to connect with the telephone station. The contact of pilot relay PT^7 which connects to this lamp is numbered **257** since this is the code number which will be recorded on the tape.

Line impulsing and stepping operation.—A person at Station No. 37 desiring to initiate a call removes the receiver from the switch hook, thereby closing a circuit from the (+) terminal of battery B, upper winding of line relay L^1, line conductor **13**, primary winding **14** of the induction coil, switch hook contact **15**, transmitter **16**, line conductor **17** and lower winding of relay L^1 to the (−) terminal of battery B.

Relay L^1 is picked up and closes a circuit for picking up storing relay SR^1 which extends from (+), front contact **18** of relay L^1, back contact **19** of relay CO^1 and upper winding of relay SR^1, to (−). Relay SR^1 closes a stick circuit for itself extending from (+), front contact **20** and upper winding of relay SR^1, to (−). The operation of relay SR^1 closes a circuit for picking up code determining relay CD^1 extending from (+), brush **21** of the code transmitter in its normal position N, front contact **22** of relay SR^1, back contact **23** and winding of relay CD^1, to (−). Relay CD^1 closes a stick circuit for itself by way of its make-before-break front contact **23** to (+) at front contact **24** of relay SR^1.

A circuit is now closed for energizing the stepping line conductor of the code transmitting

trunk with a low current value, which circuit extends from (+), high and low resistance windings in series of relay F, front contact 25 of relay CD^1, stepping line conductor 26, back contact 127 of impulsing relay P^1 associated with the code receiver and winding of line relay F^1 to the (−) terminal of battery B^1. The return path for the current in this circuit to the starting point (+) is through the ground, as indicated by the (+) terminals of both batteries B and B^1 being connected to ground.

This low degree of current in the stepping line is effective to pick up line relay F at the transmitting end but line relay F^1 at the receiving end is of such value and is marginally adjusted so that it does not pick up at this time. The actuation of the contacts of relay F closes a circuit for picking up slow acting relay SA which extends from (+), brush 28 in position N, front contact 29 of relay F and winding of relay SA, to (−).

It should be pointed out here that relay SA remains up during a cycle of operations, even though its energizing circuit is interrupted during impulsing of the line at contact 29 of relay F. This slow acting relay has such characteristics that it does not release its armature during the periods of the cycle when relay F is down.

A circuit is now closed for energizing the switch stepping magnet STP which extends from (+), front contact 30 of relay SA, front contact 31 of relay F and winding of magnet STP, to (−). Condenser 32 bridged across the winding of magnet STP is the usual means for quenching the spark at contacts 31 and 33 during stepping. The energization of magnet STP is effective to operate the pawl of the switch for engaging the next tooth on the ratchet wheel which drives the switch shaft.

The operation or picking up of magnet STP closes a circuit for short circuiting the high resistance winding of line relay F by way of its front contact 34. This removes the high resistance from the above traced circuit including the stepping line but maintains this line conductor energized through the low resistance winding of relay F and the winding of relay F^1 in series. This results in a substantial increase in the current flow in the stepping line so that relay F^1 at the receiving end is picked up.

A circuit is now closed from (+), brush 100 of the receiver switch in its normal position N, front contact 101 of relay F^1 and winding of relay SA^1, to (−). Relay SA^1 picks up and applies (+) potential through its front contact 102 to stick conductor 103. A circuit is closed from (+), through front contact 102 of relay SA^1, front contact 104 of relay F^1 and the winding of the code receiver stepping magnet STP^1, to (−). Magnet STP^1 energizes and operates the pawl and ratchet mechanism in the same manner as explained for the code transmitter. It will be understood that the brushes are not advanced at this time.

A circuit is now closed for picking up impulse relay P^1 extending from (+), front contact 105 of magnet STP^1 and lower winding of relay P^1, to (−). The operation of relay P^1 opens the stepping line conductor at its back contact 127, which is effective to deenergize the stepping line and release relays F and F^1.

The release of relay F opens the circuit of magnet STP at contact 31 and the release of relay F^1 opens the circuit of magnet STP^1 at contact 104. These two stepping magnets release their armatures and by means of the pawl and ratchet mechanism, brushes 21 and 28 of the transmitter are advanced to position 1 and brushes 100 and 110 of the receiver mechanism are advanced to position 1.

The release of magnet STP removes the short circuit from the high resistance winding of relay F, so that both windings of this relay will be included in the circuit when the stepping line is next energized. The release of magnet STP^1 opens its front contact 105 which is effective to drop relay P^1 which again energizes the stepping line by closing its back contact 127.

The stepping line is now energized with a low current value (since contact 34 of magnet STP is now open) and relay F is again picked up. Magnet STP is again energized by way of the previously described circuit through front contact 31 of relay F. The high resistance winding of relay F is short circuited at front contact 34 of the stepping magnet when it operates. Relay F^1 again picks up and closes the previously described circuit for operating magnet STP^1, after which relay P^1 is again picked up for opening the stepping line.

This synchronized operation at the transmitting and receiving ends continues until both switches reach position 8. During this step-by-step operation, relay SA establishes an energizing circuit for itself through its own front contact 35 and front contact 29 of relay F. Relay SA^1 establishes a similar energizing circuit for itself by way of its front contact 111 and front contact 101 of relay F^1. From the above description it will be noted that the code transmitter and code receiver reach position 8 at substantially the same time.

With the code transmitter in position 8, a circuit is closed for picking up relay CO^1 which extends from (+), brush 21 in position 8, conductor 36, front contact 57 of relay CD^1 and winding of relay CO^1, to (−). Relay CO^1 establishes a stick circuit for itself extending from (+), front contact 38 of relay CO^1, front contact 39 of relay L^1 and winding of relay CO^1, to (−). This stick circuit is effective to maintain relay CO^1 picked up as long as the line circuit is closed by the receiver being off the switch hook. This is for the purpose of preventing the code transmitter being started through another cycle of operations when it reaches its normal position, due to relay L^1 being up. By means of this stick circuit, the front contact 18 of relay L^1 is ineffective to again pick up relay SR^1 because of the open point in this circuit at back contact 19 of relay CO^1.

Relay CO^1 closes a circuit which is effective to release relay SR^1, which circuit extends from (+), front contacts 38 and 40 of relay CO^1, front contact 41 of relay CD^1, front contact 42 of relay SR^1 and lower winding of relay SR^1, to (−). Relay SR^1 is released because of the differential connections of its two windings, that is, the last described circuit through its lower winding energizes the core of this relay in an opposite sense to the engerizing stick circuit through its upper winding.

The release of relay SR^1 opens the stick circuit of relay CD^1 at front contact 24 and this relay releases and opens the stepping line conductor at its front contact 25. The deenergization of the stepping line conductor results in the release of relays F and F^1 and they remain down for a sufficient time to allow relays SA and SA^1 to drop

away, due to their circuits being open at contacts 29 and 101 respectively.

The code transmitter is now advanced to position N by means of a circuit extending from (+), brush 28 in either of its positions 8 or 9, back contact 43 of relay SA, back contact 33 and winding of magnet STP, to (—). Since this circuit includes a back contact of the stepping magnet, this magnet will be energized and deenergized by the opening of contact 33 so that a self-interrupting circuit is effective for advancing the switch brushes to position N, where the switch stops because the self-interrupting magnet circuit is opened by brush 28 in position N.

A similar circuit is established at the receiving end extending from (+), brush 100 in positions 8 and 9, back contact 112 of relay SA^1, back contact 113 of magnet STP^1 and winding of this magnet to (—). It will be noted that a circuit in multiple with the above extends through back contact 114 of relay SA^1 and the upper winding of relay P^1, to (—). This circuit is effective to pick up relay P^1 and maintain both conductors of the code transmitting trunk open until the code receiver reaches its normal position. This prevents the start of another cycle of operations until the code receiver has reached its normal position. Another cycle of operations likewise can not be started until the code transmitter reaches its normal position and connects (+) potential by way of its brush 28 to front contact 29 of relay F.

Simultaneous calls.—Assuming that more than one telephone station initiates calls at the same time, it will be obvious that the line relays similar to relay L^1 associated with these telephone stations will be up at the same time. Under this condition, the storing relays associated with these different line circuits will likewise be picked up and they will be stuck up by means of their upper windings to store these calls.

Since the pick-up circuit of the code determining relays similar to relay CD^1 is not effective until the code transmitter (brush 21) is in its normal position, it will be evident that no code determining relay can be picked up to interfere with the code of a station which is transmitting. Also, since this pick-up circuit for the code determining relays extends through series contacts 22, 52, 62, etc. of all storing relays, only the code determining relay associated with the line nearest the start of this series circuit can be picked up when a plurality of storing relays are up at the same time. Under this condition when the end of a cycle is reached and the storing relay associated with the line which obtained access to the code transmitting circuit is released, the next code determining relay in order nearest the start of this series circuit can be picked up to transmit its code combination.

This series or extended start wire arrangement which extends through contacts of all storing relays of the group is shown terminating on an alarm relay AL. As long as the code transmitter and all storing relays are normal, a circuit extends from (+), brush 21 in position N, back contacts of all storing relays in series and the winding of relay AL, to (—). During the regular operation of the system, these storing relays and the code transmitter will not interrupt this series circuit for more than a few seconds at one time. By connecting a delayed alarm circuit arrangement such as a thermal relay or a dash pot relay to the contacts of relay AL and the source of current, an alarm will be given when this series circuit remains open for any length of time due to a trouble condition.

From the above it is obvious that, in the case of a plurality of simultaneous calls, the code transmitter and code receiver will be stepped around in synchronism through a plurality of operating cycles until all of the calls have been taken care of. It will be noted that when any of the code determining relays are picked up, the stepping line circuit is closed by way of front contacts 25, 44, 45, etc.

Common lamp CL or the alternate arrangement of a single stroke gong as above mentioned, is operated when relay SA^1 at the code receiver picks up and closes its front contact 102. As above mentioned, this indication is for the purpose of giving the operator a signal slightly in advance of the numerical registration of the calling station, so that he will be expecting the call.

Station registration.—It will now be assumed that the code transmitter and code receiver operate through one cycle due to the initiation of a call from station No. 37 as above described. It is also assumed that the code combination (No. 257) of this station requires the connection of code wires 2, 5 and 7 of brush 21 of the transmitter to the message line. It will be understood that the seven code wires leading to and through bracket CW are connected to the code determining relays in different combinations, a separate combination for each individual line.

When the code transmitter passes positions 1, 3, 4, 6, 8 and 9, no circuits are completed for energizing the message line. With the code transmitter switch in position 2 and the code receiver in position 2, a circuit is closed for picking up pilot relay PT^2 which extends from (+), brush 21 of the code transmitter in position 2, conductor 2, front contact 10 of relay CD^1, message line conductor 46, back contact 147 of relay P^1, front contact 115 of relay SA^1, brush 110 in position 2 and winding of relay PT^2, to (—). Relay PT^2 closes a stick circuit for itself by way of its front contact 116 to stick conductor 103.

When the code transmitter and code receiver reach their positions 5, a circuit is closed from (+), brush 21 in position 5, conductor 5, front contact 11 of relay CD^1, message line conductor 46, back contact 147 of relay P^1, front contact 115 of relay SA^1, brush 110 in position 5 and winding of relay PT^5, to (—). Relay PT^5 picks up and closes a stick circuit for itself by way of its front contact 117 to stick conductor 103.

When the two stepping switches each reach position 7, a similar circuit is closed in position 7 of brush 21 and front contact 12 of relay CD^1 to the message line. This circuit is completed by way of brush 110 in position 7 and the winding of relay PT^7, to (—). Relay PT^7 picks up and closes a stick circuit for itself by way of its front contact 118 to stick conductor 103.

With the code receiver in position 8 (and position 9 at the time it is restored to normal by the release of relay SA^1), a circuit is closed for picking up the individual station relay ST. This circuit extends from (+), back contact 115 of relay SA^1, brush 110 in positions 8 and 9, back contact 119 of relay PT^1, front contact 120 of relay PT^2, front contact 121 of relay PT^5, front contact 122 of relay PT^7 and winding of relay ST, to (—). Relay ST closes a stick circuit for itself extending from (+), back contact 123 of the common release key, front contact 124 and the winding of relay ST, to (—). The station lamp SL is connected in multiple with relay ST

so that this lamp lights and by means of its number (37) indicates to the operator the number of the calling station.

The operator now inserts a plug associated with the fire switchboard into one of the talking trunk jacks and by means of the operator's calling device dials No. 37, which is effective to advance the connecter switch associated with the chosen trunk jack to the the terminals associated with line No. 37. Since this operation is well known in automatic telephone practice, it is not believed necessary to show or describe it in detail.

When the connecter switch is advanced to the terminal associated with line No. 37, (+) or ground potential is connected in the well-known manner through connecter brush S to the test or sleeve conductor 47. This ground extends through back contact 48 of relay SR^1 and winding of relay CO^1, to (—) and is for the purpose of holding relay CO^1 in its picked up position as long as the operator leaves the plug in the trunk jack, so that the calling party cannot initiate other cycles of operation of the code switches by flashing the switch hook and intermittently operating line relay L^1. Since relay CO^1 remains up as long as the connecter switch is connected to the terminals of this line, any actuation of contact 18 on relay L^1 is ineffective.

Since the operator's telephone circuit is associated with the cord circuit in the well-known manner and since the cord circuit is connected to the talking trunk, it will be obvious that the conversation may be carried on between the operator and the party at the calling telephone by way of the connecter switch. When the necessary information is passed over the talking trunk, the removal of the plug from the trunk jack releases the connecter switch, which is effective to remove the (+) or ground potential from conductor 47, allowing relay CO^1 to drop. The relays associated with this particular line are now in their normal positions and another call can be initiated from this station.

After the operator makes the necessary record of the number of the calling station as identified by lamp SL, he may release relay ST and extinguish this lamp by momentarily depressing the common release key, which opens the stick circuit of relay ST and since lamp SL is in multiple with this relay, the lamp circuit is deenergized.

It will be noted that the code wires leading from brush 21 of the code transmitter to the contacts of relay CD^1 are indicated No. 257 and that the front contact 122 of relay PT^7 which connects to the relay ST is likewise indicated No. 257. This refers to the positions of the code transmitter and code receiver in which the message line is energized for picking up corresponding pilot relays.

It will be understood that when a relay similar to relay CD^1 is picked up, which does not have any contacts in connection with any of the code wires leading to brush 21 of the transmitter, none of the pilot relays associated with the code receiver will be picked up during the cycle. In this case, when positions 8 and 9 are reached and the circuit closed from (+) by way of brush 110 through back contacts 119, 120, 125, 126, 128, 139 and 129, the circuit will be completed by way of conductor 130 to an individual station relay which will correspond to code No. 000.

When a code determining relay has contacts connected to all seven of the wires leading to brush 21 of the code transmitter, then all of the seven pilot relays associated with the code receiver will be picked up and a circuit will be completed through front contact 119 of relay PT^1 and front contacts (not shown) of all the other pilot relays to an individual station relay which corresponds to code No. 1234567.

It will be apparent from the above discussion that the two conditions (open and closed) of the message line conductor during each of the seven steps of the code switches, results in the selection of a number of individual combinations or stations which equals two raised to the power of the number of steps. In other words, use is made of the Baudot code for transmitting code combinations. It will also be understood that all of the front and back contacts of the first six pilot relays will be wired through front and back contact combinations of each succeeding relay in the so-called pyramid fashion, for obtaining access to any one of the one hundred twenty-eight combinations provided.

It was previously mentioned that it is proposed to provide police box service in connection with the fire alarm service in this embodiment of the invention. It will be understood that the operator may dial a wanted station over one of the talking trunks leading to the branch office in which this station is located, even though there is no receiver off the hook. When the associated connecter reaches the terminals of the wanted line, ringer 49 will be operated by means of the automatic ringing current ordinarily provided at the connecter circuit, or this ringer may be operated by means of a manual ringing circuit at the fire switchboard.

Back contact 48 of relay SR^1 has been provided to interrupt the circuit of conductor 47 which leads to relay CO^1, so that relay CO^1 cannot be picked up to interfere with the transmission of a coded fire alarm, due to the operator dialing the number of the station sending in this alarm while it is being transmitted. Contact 48 prevents the application of (+) or ground potential to the winding of relay CO^1 under the above condition until the storing relay has been released. After the release of this relay it is of course proper for a connection to be made to the cut-off relay CO^1.

When the called party answers an outgoing call, the operation of relay L^1 is ineffective to start the code transmitting mechanism because the circuit of relay SR^1 is open at back contact 19 of relay CO^1.

The battery supply for the telephone at the station during either class of connection is through the windings of line relay L^1 of the individual line circuit equipment. It will be noted from the above description that should a trouble condition exist whereby the operator was not able to complete a talking connection by way of the connecter switch to the calling station, the identity of the station is established and maintained by means of the station lamp until the operator is ready to restore this visual indication to normal.

In the event that calls from a plurality of stations occur at substantially the same time, they will be recorded at the fire switchboard with a delay of only a few seconds between calls. The operator can obtain simultaneous communication with two such calls by means of the two talking trunks shown in the present embodiment and if desired to arrange for more than two such simultaneous connections, additional jacks, trunks and connecters may be provided.

Applicant's system also contemplates the ex-

tension of the plan disclosed in Fig. 1 to include any number of branch offices by simply duplicating at each branch office the arrangement shown. In this event, the operator's cord, dial and telephone circuits would be used in common in connection with the talking trunks to all of the branch offices, when the size of the system warrants, or if desired for reserve or other purposes, one or more switchboard positions can be added with multiple appearances of the lamps and jacks.

It will also be obvious that the fire switchboard may be located in the same office with equipment similar to that shown in the branch office of Fig. 1. This would be the case in a multi-office plant because there would be a large number of alarm stations terminating in the centrally located office in which the fire switchboard would be installed.

Description of modification.—Figs. 4 and 5 illustrate a modified provision for recording incoming calls which may or may not be used in conjunction with the recording means of Fig. 3 already described. It will be unnecessary to again describe in detail the operation of the system and only so much as has been modified will now be explained.

The use of this modification in conjunction with the station identifying lamp arrangement provides a double record of each incoming call, first by means of the station lamp (No. 37 for example) and second by means of a punched or printed record on a tape (No. 257 for example, as indicated in Fig. 5).

Referring to Fig. 4, the seven pilot relays which decode the incoming call are shown as double wound relays. The upper windings of these relays are separate stick windings and the lower windings are the pick-up windings which are connected to terminals 1 to 7 inclusive of brush 110. The common connection to the lower windings is connected through printer relay PR, to (—).

The recording device RD illustrated in Fig. 4 is energized each time brush 110 completes an energizing circuit through a lower winding of one of the pilot relays. This is due to the fact that relay PR is operated in series with any one of the seven pilot relays and closes a circuit from (+), front contact 301 of relay PR and winding of recording device RD, to (—).

Assuming that code No. 257 is transmitted during a cycle of operations, the recording device RD will operate its armature 302 to punch or mark tape 303 at the time each of the pilot relays PT^2, PT^5 and PT^7 is energized.

The tape feeding mechanism may be synchronized with the code receiver stepping switch in any desired manner, such as a direct or geared connection between the tape feeding mechanism and the shaft of the rotary switch. This is possible because the rotary switch always advances in a clockwise direction.

Therefore, the upper row of punched or printed marks as illustrated in Fig. 5 may be located to correspond with the seven code positions of the code receiver. With this arrangement, it will be evident that the energization of armature 302 of the recording device when code No. 257 is being received, results in recording a punched or marked indication immediately below positions 2, 5 and 7 as indicated in Fig. 5.

It will be obvious that relay PR may be connected directly to terminals 1 to 7 inclusive of brush 110 of the code receiver if it is desired to operate the system with only a tape record of the code. In this event, the pilot relays and the individual station relays and lamps would not be required. However, the operator would need to make a translation of the code number to the line number before he could dial the calling station.

From the above description of one specific form of the invention and one modified provision, it will be apparent that applicant has developed a system in which a large number of alarm stations may be connected by individual circuits to branch offices in sections where these stations are located and by means of the common code transmitting arrangement, the identification of a calling station or simultaneous calling stations, is obtained and means provided for telephone communication with these stations, all by means of a very small number of line conductors between the different branch offices and a central office at which the fire or police operator's switchboard is located.

Having thus complied with the statutes and shown and described a preferred embodiment of the invention, it is to be understood that the particular arrangements illustrated are only typical of applicant's invention and are not intended to show the exact circuit design necessary to carry out the features of the invention but have been selected to facilitate in the disclosure rather than to limit its scope and it is further desired to be understood that various modifications may be made in order to meet the various problems encountered in practice and that the system may be varied in the number of telephone substations and the number of branch offices to which the system is applied, all without in any manner departing from the spirit or scope of the present invention except as limited by the appended claims.

What I claim is:

1. The method of operating a fire alarm system which consists in synchronously driving a common code transmitter and a common code receiver connected by a common trunk circuit by means of a first series of impulses, transmitting over said trunk circuit the identity of calling alarm stations to an operator's switchboard by means of a second series of impulses, and selectively establishing talking connections to said alarm stations from said switchboard over another trunk circuit common to said alarm stations.

2. The method of operating a fire alarm system which consists in synchronously operating a common code transmitter and a common code receiver connected by a common trunk circuit by means of a first series of impulses, successively transmitting by means of a second series of impulses during the synchronous operation of said code transmitter the identity of simultaneous calling alarm stations to an operator's switchboard over a trunk circuit common to said alarm stations, recording the identity of the calling alarm stations by means of said second series of impulses, and selectively establishing simultaneous separate talking connections to said alarm stations from said switchboard over other trunk circuits common to said alarm stations.

3. In an alarm system, a plurality of alarm stations, a first office, a second office, individual lines connecting said stations with said first office, a common code transmitter at said first office and a common code receiver at said second office synchronously operated by means of a non-coded series of impulses applied to a common trunk circuit connecting said transmitter and said receiver, individual signals at said second office corresponding to said stations, and

means including said code transmitter and said code receiver controllable over said circuit for selectively actuating said signals by means of a coded series of impulses.

4. In an alarm system, a plurality of alarm stations, a first office, a second office, individual lines connecting said stations with said first office, a common code transmitter at said first office and a common code receiver at said second office operable in synchronism by means of a non-coded series of impulses applied to a common trunk circuit connecting said transmitter and said receiver, individual signals at said second office corresponding to said stations, and means comprising a coded series of impulses controllable over said circuit during the synchronous operation of said transmitter and said receiver for selectively actuating said signals to identify calling stations.

5. In an alarm system, a plurality of alarm stations, a first office, a second office, individual lines connecting said stations with said first office, a common code transmitter at said first office and a common code receiver at said second office operable in synchronism by means of a non-coded series of impulses applied to a common trunk circuit connecting said transmitter and said receiver, individual signals at said second office corresponding to said stations, and means comprising a coded series of impulses controllable over said circuit during the synchronous operation of said transmitter and said receiver for successively and selectively actuating said signals whereby simultaneous calling stations are simultaneously identified.

6. In an alarm system, a plurality of alarm stations connected by individual lines to a central office, a common code transmitter and a common code receiver connected by a circuit common to said lines, means responsive to the distinctive conditioning of said lines for initiating calls, means responsive to the initiation of calls for applying a non-coded series of impulses to said common circuit whereby said transmitter and said receiver are operated in synchronism, means for transmitting the identification of calling lines over said common circuit by a series of coded impulses transmitted during the synchronous operation of said transmitter and said receiver, and means responsive to said series of coded impulses for displaying the identity of calling lines on lamps individual to said lines.

7. In an alarm system, a plurality of alarm stations connected by normally deenergized individual lines to a central office, a circuit common to said lines, means responsive to the energization of said lines for initiating calls, means responsive to the initiation of calls for effecting the transmission of the identification of calling lines over said common circuit, signals for displaying the identity of calling lines, and means responsive to said transmission for causing said signals to simultaneously display the identity of a plurality of calling lines.

8. In an alarm system, a plurality of alarm stations, a first office, a second office, individual lines connecting said stations with said first office, individual signals corresponding to said stations at said second office, a common circuit connecting said offices, step-by-step mechanism at each of said offices operated in synchronism by a plurality of impulses applied to said circuit, and means controlled over said circuit for selecting the individual signals corresponding to calling stations.

9. In an alarm system, a plurality of alarm stations, a first office, a second office, individual lines connecting said stations with said first office, individual signals corresponding to said stations at said second office, a common stepping line connecting said offices, step-by-step mechanism at each of said offices operated in synchronism by a plurality of impulses applied to said stepping line, a common message line connecting said offices, and means controlled by a combination of impulses applied to said message line for selecting said individual signals in response to corresponding calling stations.

10. In a fire alarm system, a plurality of manually controlled fire alarm stations connected to a central office, step-by-step code transmitting mechanism in said office, means responsive to a call from one of said stations for advancing said mechanism through an operating cycle, and means operable during said cycle for distinctively registering any one of said stations in said office, the number of said stations equaling two raised to the power of the number of steps taken by said mechanism during said cycle.

11. In a fire alarm system, a plurality of manually controlled fire alarm stations connected to a central office, step-by-step code transmitting mechanism in said office, means responsive to simultaneous calls from said stations for advancing said mechanism through operating cycles, and means operable during said cycles for distinctively registering said stations in said office, the total number of said stations which may be distinctively registered equaling two raised to the power of the number of steps taken by said mechanism during each of said cycles.

12. In a fire alarm system, a plurality of manually controlled fire alarm stations connected to a central office, step-by-step code transmitting mechanism and step-by-step code receiving mechanism in said office, means responsive to a call from one of said stations for advancing said mechanisms through an operating cycle, and means operable during said cycle for distinctively registering said one of said stations in said office, the number of stations which can be distinctively registered equaling two raised to the power of the number of steps taken by said mechanisms during said cycle.

13. In an alarm system, the combination of means controlled by a series of impulses corresponding to the Baudot code for recording the identity of a calling station at a central office, and means controlled by a plurality of series of decimal impulses for checking the identity of said stations.

14. In an alarm system, the combination of means controlled by a plurality of series of impulses corresponding to the Baudot code for recording the identity of calling stations at a central office, and means controlled by a plurality of series of decimal impulses for checking the identity of said stations.

15. In an alarm system, the combination of means controlled by a series of impulses corresponding to the Baudot code applied to a common code transmitting circuit for recording the identity of calling stations each connected by individual circuits to a central office, and means controlled by a plurality of series of decimal impulses applied to another common circuit for checking the identity of said stations.

16. In a telephone system, a plurality of telephone lines each having an arbitrary designation, a plurality of identifying conductors for each of

said telephone lines, an operator's position, means responsive to a calling telephone line for impressing an electric potential on the identifying conductors of the calling telephone line in a distinctive combination, and means responsive to said combination for indicating the arbitrary designation of said calling telephone line on an individual line lamp at said operator's position.

17. In a telephone system, a plurality of telephone lines, each having an arbitrary designation, a plurality of identifying conductors for each of said telephone lines, an operator's position, means responsive to simultaneous calls from a plurality of calling telephone lines for impressing an electric potential on the identifying conductors of the associated calling telephone lines in distinctive combinations for simultaneously indicating the arbitrary designations of said calling telephone lines on individual line lamps at said operator's position.

18. In a telephone system, a plurality of stations connected to a central office, step-by-step code transmitting mechanism and step-by-step code receiving mechanism in said office, means responsive to a call from one of said stations for advancing said mechanisms through an operating cycle, means operable during said cycle for distinctively registering the identity of said one of said stations in said office, and means for checking the operation of said mechanisms whereby the response of each is dependent upon the response of the other.

19. In a telephone system, a plurality of stations connected to a central office, step-by-step code transmitting mechanism and step-by-step code receiving mechanism in said office, means responsive to a call from one of said stations for advancing said mechanisms through an operating cycle in synchronism, transmitting means effective during the operation of said mechanisms for transmitting the identity of said one of said stations, and registering means effective during the operation of said mechanisms for registering the identity of said one of said stations, and checking means independent of said mechanisms for checking the identity of said station.

20. In a telephone system, a central office, a plurality of district offices connected with said central office, stations connected with said district offices, signal transmitting means at each of said stations, means responsive to the transmission of a signal from one of said stations for generating and transmitting a coded signal from said district office to said central office, said coded signal being distinctive to said transmitting station, means at said central office responsive to the reception of the complete coded signal for translating and visibly indicating the signal into a decimal signal, and means at said central office responsive to the reception of the complete coded signal for visibly indicating said coded signal.

21. In a telephone system, the combination with a plurality of stations, central office equipment comprising a code transmitter, a code determining relay for each station, means controlled by each code determining relay for causing said transmitter to transmit the identity of the associated station to an operator's switch board, means responsive to a calling station for operating the associated code determining relay, and interlocking circuits for said code determining relays for permitting the operation of only one at any one time and in a predetermined order.

22. In a telephone system, a central office and a plurality of stations, a code transmitter, means responsive to calling stations for causing said transmitter to transmit a plurality of series of impulses each series comprising a different code, a storage relay and a code determining relay for each station, means responsive to a call from one of said stations for operating the associated storage relay, means responsive to the operation of said storage relay for operating the associated code determining relay, means controlled by the operated code determining relay for causing said transmitter to transmit the identity of the associated station to said office, means including interlocking circuits between said code determining relays for preventing more than one being operated at any one time, and means controlled by said transmitter for releasing the operated code determining relay and the associated storage relay.

23. In a telephone system, a central office and a plurality of stations, a code transmitter, means responsive to calling stations for causing said transmitter to transmit a plurality of series of impulses each series comprising a different code, a storage relay and a code determining relay for each station, means responsive to a plurality of calls from a plurality of said stations for operating the associated storage relays means responsive to the operation of said storage relays for operating the associated code determining relays, means controlled by the operated code determining relay for causing said transmitter to transmit the identity of the associated station to said office, means including interlocking circuits between said code determining relays for preventing more than one being operated at any one time, and means controlled by said transmitter for releasing the operated code determining relay and the associated storage relay.

24. In a telephone system, a central office and a plurality of stations, line circuits connecting said stations with said office, a selective type communication system in said office, relays in said office corresponding to said stations, circuits for operating said relays, means controlled by said relays for causing said communication system to display the identity of calling stations, and interlocking circuits controlled by contacts of said relays for preventing the simultaneous operation of more than one of said relays.

25. In a telephone system, a central office and a plurality of stations, relays in said office corresponding to said stations, means responsive to simultaneous calling stations for individually and sequentially operating said relays, means controlled by said relays for individually and sequentially registering the identity of said calling stations in said office, and means including said relays for predetermining the order of their sequential operation in response to simultaneous calls.

26. In an alarm system, a plurality of alarm stations connected by normally de-energized individual lines to a central office, a circuit common to said lines for initiating calls, means responsive to the initiation of calls for effecting the transmission of the identification of the calling lines over said common circuit, signals for displaying the identity of calling lines, and means responsive to said transmission for causing said signals to simultaneously display and permanently record the identity of a plurality of calling lines.

WINFRED T. POWELL.