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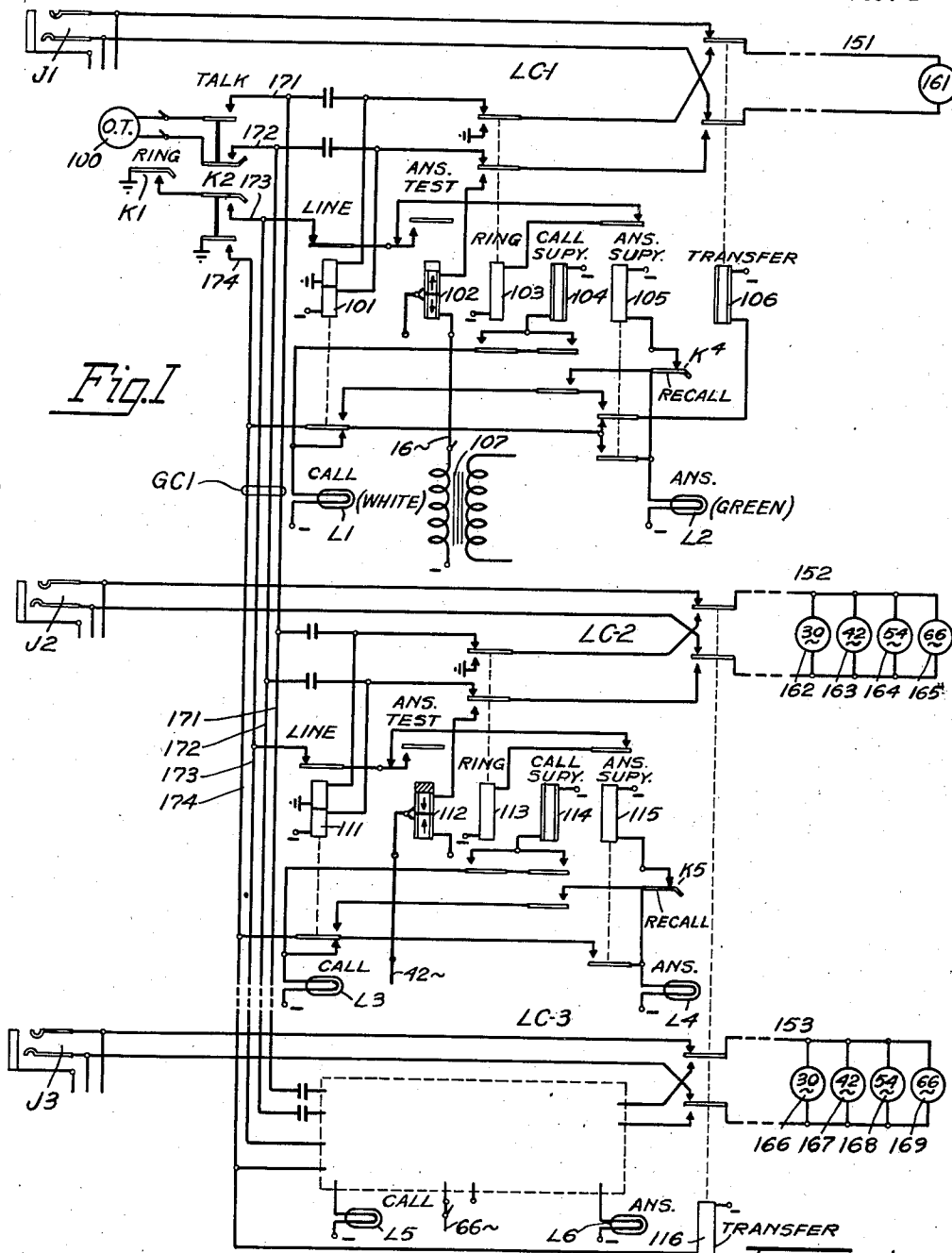
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2,298,489

GROUP-CALL TELEPHONE SYSTEM

Filed Sept. 10, 1941

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

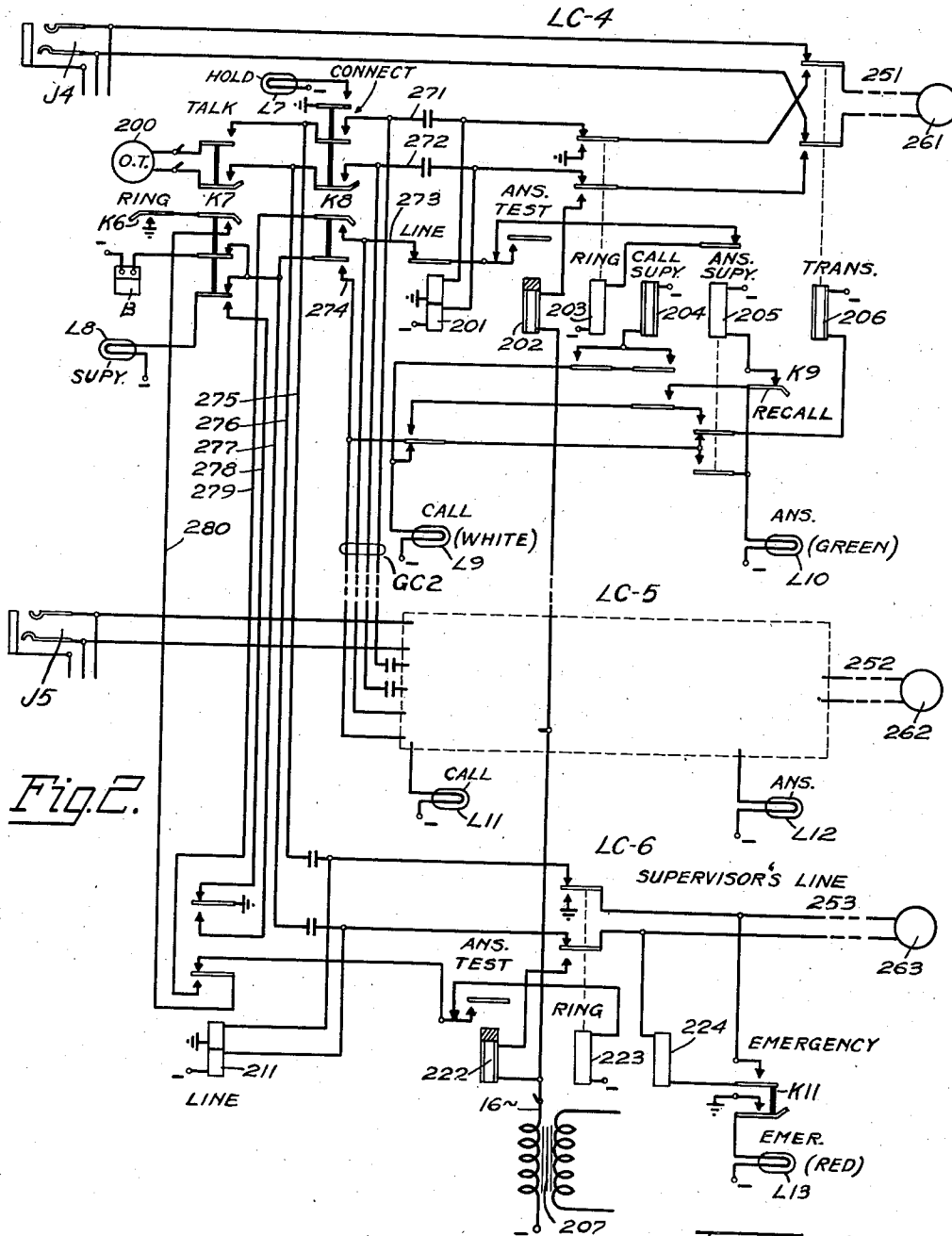


Fig. 2.

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UNITED STATES PATENT OFFICE

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GROUP-CALL TELEPHONE SYSTEM

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10 Claims. (Cl. 179—5)

This invention relates to group-call telephone systems, and the object is to provide a new and improved arrangement for enabling preselected subscriber lines to be called as a group.

General description

The system of the invention may be used, for example, in calling volunteer firemen over regular subscriber lines to inform them of the location of a fire.

A group-call line is provided with branches corresponding respectively to the separate telephone lines constituting the group to be called. Each branch is provided with ringing equipment and supervisory equipment. Means is provided, controlled over the group-call line, for transferring each of the subscriber lines of the preselected group from its regular switchboard terminals to its corresponding branch of the group-call line.

A feature of the invention is that each of the idle lines of the group is transferred from the group-call line into its ringing circuit when the operator starts the ringing operation, and becomes automatically disconnected from the ringing circuit and connected back to the group-call line when the call is answered on such line. As a consequence, the group-call operator may converse with the subscribers one by one as they respond, the ringing continuing on the other lines while the group-call operator is conversing with those who have already responded, all of the lines finally becoming connected back to the group-call circuit when a response has been obtained on all lines.

A further feature is that a line over which a response has been obtained may be automatically disconnected from the group-call circuit and transferred back to the regular switchboard terminals upon the receiver being replaced at the responding substation. This arrangement enables any desired one of the lines of the group to be immediately transferred back to normal telephone service to enable a regular call to be made from or received at such line. This feature is particularly advantageous for the line of a fire chief or other person who occupies a supervisory position.

According to a further feature, arrangements are provided whereby any desired line of the group may be recalled after a response has been obtained and the receiver has been replaced. This feature enables the subscriber to be recalled to receive additional or change instructions.

According to a further feature, the group-call

operator is provided with an individual supervisory signal for each branch of the group-call circuit to indicate which of the transferred lines (if any) are in use. The group-call operator may converse with any subscribers thus telephonically connected to the group-call circuit and request any who are not the desired subscribers to replace the receiver.

Individual supervisory signals also keep the operator informed at all times of the answered or unanswered condition on each line.

According to a still further feature of the invention, a supervisor's line is so associated with the group-call circuit that the group-call operator must first call the supervisor over his line and obtain a response thereover before she is able to call the subscribers over the group-call circuit. This feature enables the supervisor to use discretion in determining whether or not the group-call operator is to call the preselected group.

An associated feature is that, in an emergency, the group-call operator is able to simulate a response on the supervisor's line when the group-call operator knows that the need for calling the group of subscribers is urgent and immediate and is unable to obtain a response on the supervisor's line.

A further feature is that the supervisor himself may signal the group-call operator by removing the receiver on his line to instruct her to call the group of subscribers. This latter feature is valuable when, for example, some or all fire reports are made directly to the supervisor rather than to the group-call operator.

Other objects and features of the invention will become more apparent as the description progresses.

The drawings

Referring now to the accompanying drawings, comprising Figs. 1 and 2, they show by means of the usual circuit diagrams a sufficient amount of the apparatus involved in a group-call telephone system embodying the features of the invention to enable the invention to be understood.

Fig. 1 shows the system especially adapted for use when the group-call operator is expected to exercise the desired discretion as to when to call and when not to call the lines constituting the group.

Fig. 2 is a desirable modification especially adapted for use when a remote supervisor exercises the discretion as to when to call and when not to call the group.

In Fig. 1, the group-call line GCI is shown con-

nected in common to the left-hand portion of each of the line circuits LC—1 to LC—3, individual respectively to the lines 151 to 153.

Being regular subscriber lines, the lines 151 to 153 normally extend (through the indicated transfer-relay contacts) respectively to the switchboard jacks J1 to J3 and their multiples, whereby incoming and outgoing telephone service may normally be obtained.

The group-call operator, whose telephone is indicated at 100, may make connection (through the group-call line GC1) with all of the circuits LC—1 to LC—3 by means of the talking key K2.

The group-call operator is provided with a ringing key K1, through which she can bring about the operation of a ringing relay in each of the circuit LC—1 to LC—3 to cause ringing current to be projected over the lines 151 to 153.

Referring particularly to the line circuit LC—1, relay 101 is the line relay arranged to supply talking current to the line 151 and to exercise control over the other relays of the line circuit; relay 102 is the answer-test relay arranged to bring about the termination of the ringing operation when an answer is secured on the line 151; relay 103 is the ringing relay arranged to transfer the associated called line from the group-call line to the ringing circuit when the key K1 is operated; relay 104 is the call supervisory relay, being operated when the ringing operation is started in the line circuit LC—1; relay 105 is the answer supervisory relay arranged to be operated through contacts of relay 104 to give answered supervision; relay 106 is a transfer relay, which transfers the line 151 from the jack J1 and its multiples to the group-call circuits GC1; L1 and L2 are the call and answer-supervisory lamps; and the key K4 is a recall key which may be actuated by unlock and restore answer-supervisory relay 105 to enable a new ringing operation to be initiated.

Referring now particularly to the line circuit LC—2, relays 111 to 115 correspond respectively in function to relays 101 to 105 of the line circuit LC—1. Similarly, the key K5 and lamps L3 and L4 correspond respectively to the key K4 and lamps L1 and L2 of the line circuit LC—1. Transfer relay 116 is associated in common with line circuits LC—2 and LC—3.

The line circuit LC—3, indicated as a broken line rectangle, may be similar to the line circuit LC—2.

It is to be noted that the conductors 171 and 174 of the group-call circuit GC1 are broken between the line circuits LC—2 and LC—3. This break is to indicate that as many additional line circuits as desired may be inserted between line circuits LC—2 and LC—3.

It is to be observed that the line 151 is an individual line, having substation 161 thereon, while lines 152 and 153 are party lines, each having a number of substations thereon. The invention has been illustrated in connection with a party-line system of the so-called harmonic ringing type, each of the substations on the line being run by a different frequency of ringing current, such as for example 30-cycle, 42-cycle, 54-cycle, and 66-cycle ringing current. On line 152, the subscriber at the 42-cycle substation 163 is the one to be called over the group-call line GC1. As a result, 42-cycle ringing current is arranged to be sent out through the line circuit LC—2, as indicated. Similarly, the line circuit LC—3 is provided with 66-cycle ringing current, as indicated, to adapt it for calling the subscriber at the

66-cycle substation 169 on the associated line 153.

The line circuit LC—1 is arranged to supply the usual 16-cycle ringing current to the associated individual line 161.

Referring now particularly to Fig. 2, the arrangement disclosed therein is generally similar to that shown in Fig. 1, differing principally in that the arrangement of Fig. 2 includes the supervisor's line 253 and associated circuit arrangements.

The line circuits LC—4 and LC—5 are connected in multiple to the group-call line GC2, as shown, and are assigned respectively to the subscriber lines 251 and 252. Relays 201 to 206 of the line circuit LC—4 correspond respectively to relays 101 to 106 of the line circuit LC—1. Similarly, key K9 and lamps L9 and L10 correspond respectively to the key K4 and lamps L1 and L2. The line circuit LC—5, indicated only as a broken-line rectangle, may be similar to the line circuit LC—4. The conductors 271 to 274 of the group-call line GC2 are shown broken between the line circuits LC—4 and LC—5 to indicate that as many other line circuits as desired may be interposed between the two shown.

The switchboard jacks J4 and J5 represent the normal switchboard terminals of the lines 251 and 252 respectively.

Line circuit LC—6 is individual to the supervisor's line 253, which latter line may be a special line, used only in connection with the group calls.

The line circuit LC—6 includes line relay 221, answer-test relay 222, ringing relay 223, and retard coil 224.

It is to be observed that the talking key K6 connects the conductors of the operator's telephone 200 to the talking conductors 275 and 276 extending to the line circuit LC—6, and that a tandem connection to the talking conductors 271 and 272 of the group-call line GC2 may be made through contacts of the connect key K7. The arrangement is such that the ringing key K10 cannot become connected with the ringing conductor 273 of the group-call line (even though keys K7 and K8 are operated) until a response on the supervisor's line 253 results in the operation of line relay 221; neither can ground potential be applied to the conductor 274 in the common group-call line GC2 to actuate the transfer relays such as 206 until line relay 211 of the supervisor's line 253 has been operated. The emergency key K11, however, is provided in line circuit LC—6 to simulate a response on the line 253 to enable line relay 211 to be operated in an emergency to condition the group-call circuits when no response can be obtained over the supervisor's line.

The invention having been described generally, a detailed description of the operation of the apparatus shown will now be given. The system as illustrated in Fig. 1 will be considered first.

Making common connection with the group of lines

Let it be assumed that the system of Fig. 1 is installed as illustrated to enable a group of volunteer firemen to be called when needed. When the group-call operator receives a report of a fire warranting the calling of the volunteer firemen reached over the group of lines including lines 151 to 153 to Fig. 1, the operator actuates the talking key K2, thereby connecting the conductors of the operator's telephone 100 respectively with the conductors 171 and 172 of the group-call line GC1. A ringing circuit is pre-

pared over common conductor 173, and ground potential is applied to conductor 174.

In the line circuit LC—1, the application of ground potential to conductor 174 results in the closure of an operating circuit, through contacts of answer-supervisory relay 105, for the individual transfer relay 106. Upon the operation of relay 106, the associated line 151 (whether busy or idle) is disconnected from the regular switchboard terminals, the jack J1 and multiples thereof, and is transferred through contacts of ringing relay 103 and the associated talking condensers into talking communication with the conductors 171 and 172 of the group-call line GC1. At the same time, transfer relay 116 operates to disconnect each of the party lines of the called group from its associated regular switchboard terminals and to transfer it to the talking conductors of the group-call line GC1, by way of contacts of the associated ringing relay and the associated talking condensers.

By the described operation of relays 106 and 116, the operator's telephone 100 and the group lines, including 151 to 153, are placed in common telephonic communication, through operated key K2.

Call supervisory lamps, such as L1, L3, and L5, become lighted as a result of the application of ground potential to conductor 174. Lamps L1 and L3, for example, may become lighted through contacts of line relays 101 and 111 respectively. The lighting of a call lamp individual to a line indicates to the operator that the associated line is idle. If all the group lines are idle at the moment, all of the lamps such as L1, L3, and L5 become lighted to indicate that fact to the group-call operator.

One or more lines, however, may be in use at the time the above transfer is accomplished by the described operation of relays 106 and 116. Assume, for example, that party line 152 is in use, all of the other lines of the group being idle. The busy condition of party line 153 is indicated to the group-call operator by the failure of the call lamp L3 to light, which failure of the lamp L3 to light is occasioned by the immediate operation of line relay 111 over the busy line 152.

Upon noting the unlighted condition of the call lamp L3, the group-call operator may converse with the subscriber whose receiver (not shown) is removed on line 152. If the subscriber whose receiver is removed is the subscriber at the 42-cycle substation 153, the substation of the desired fireman, the operator may request that the desired fireman at that substation be called to the telephone, unless he himself is speaking, in which event she may immediately give the desired instructions.

On the other hand, if line 152 is in use because the receiver is removed at some other substation thereon (the 30-cycle substation 162 for example), the group-call operator may explain that an emergency fire call is being made over the line and request the subscriber to replace his receiver to allow the emergency call to be made.

When the receiver has been replaced on line 152, line relay 111 restores, closing a lighting circuit for call lamp L3 over conductor 174. Lamp L3 thereupon becomes lighted to indicate that the line has become idle.

The ringing operation

After having actuated the key K2, the operator may operate the key K1 to cause ringing current

to be projected over each of the lines of the group. She may operate the key K1 and leave it operated to apply continuous ringing current, or she may operate the key K1 intermittently to cause the ringing on the lines to occur intermittently.

When the key K1 is operated, ground potential is applied, through contacts of the operated talk key K2, to conductor 173 of the group-call line GC1. The ringing relays of the several line circuits are thereupon operated. Ringing relay 103 of the line circuit LC—1 is operated through contacts of line relay 101, answer-test relay 102, and answer-supervisory relay 105. Upon operating, relay 103 applies ground potential to the upper or tip talking conductor of the called line, and applies ringing current from the 16-cycle source 107 to the lower or ring conductor of the called line. The complete ringing circuit for substation 161 on individual line 151 is from the indicated free negative pole of the grounded exchange battery, through the secondary winding of ringing transformer 107, the common 16-cycle ringing lead, the two windings of answer-test relay 102 in series, contacts of ringing relay 103, contacts of transfer relay 106, the lower or ring conductor of line 151, through the usual ringer and condenser (not shown) at substation 161, the upper or tip conductor of line 151, and thence to ground, through contacts of operated relays 106 and 103. The previously mentioned usual condenser in the ringing circuit prevents direct current from flowing until a response has been obtained and relay 102 is prevented from operating responsive to alternating current, such as by being provided with the indicated copper sleeve and copper collar.

In the line circuit LC—2, the operation of ringing relay 113 results in ringing current being applied from the illustrated 42-cycle ringing lead and through the upper winding of answer-test relay 112 to the called line 152, a return path to ground being provided through the upper contacts of relay 113. The 42-cycle ringer (not shown) at the desired substation 163 is thereby operated. At the same time, 66-cycle ringing current is similarly transmitted through the line circuit LC—3 to actuate the ringer at the 66-cycle substation 169 on party line 153.

It is to be noted that the answer-test relays 102 and 112 are similar, each being illustrated as a double-wound differential relay. This arrangement is customary when the comparatively high frequency harmonic ringing current of from 30-cycles to 66-cycles, for example, is to be transmitted through the same type of relay that may be used also for the passage of the comparatively low frequency 16-cycle ringing current used for signaling individual-line substations. The upper winding of the relay is customarily arranged with the correct number of turns for operation when any frequency of ringing current from 30-cycles to 66-cycles is used. The differentially wound lower winding of the relay is included also in the circuit (as is illustrated in connection with the line circuit LC—1) when the 16-cycle ringing current is used. The lower winding of the relay partially neutralizes the effect of the upper winding of the relay, lowering the tendency of the relay to respond during the longer half-cycles of the 16-cycle ringing current.

In the line circuit LC—1, as a further result of the operation of ringing relay 103, call supervisory relay 104 operates in a circuit including grounded conductor 174, lower contacts of line

relay 101, and the lower contacts of relay 103. At its inner contacts, relay 104 locks itself by shunting the lower contacts of relay 103. At its lower contacts, relay 104 prepares an operating circuit for answer-supervisory relay 105.

In the line circuit LC—2, call-supervisory relay 114 is operated in a similar circuit, locking itself at its inner contacts, and preparing a circuit for relay 115 at its lower contacts.

The above operation of the call-supervisory relay in each of the line circuits responsive to the starting of the ringing operation prepares for the subsequent operation of an answer-supervisory relay in each line circuit when a response occurs on the associated line.

Response

When the subscriber at substation 101 removes his receiver, the application of ringing current to his line is terminated. If the receiver is removed in the silent period between successive operations of ringing key K1 and between the consequent successive operations of ringing relay 103, line relay 101 operates directly and immediately over the called line to open the ringing circuit at its upper contacts. On the other hand, if the response occurs during an application of ringing current, the closure of the usual direct-current bridge across the conductors of the called line permits direct current to flow in the above-traced ringing circuit, whereupon answer-test relay 102 operates. Upon operating, relay 102 open-circuits and restores ringing relay 103, whereby the application of ringing current is terminated and line relay 101 is again connected to line 151. Relay 102, being slow-acting, remains operated for a slight interval after relay 103 restores. During this interval the operation of line relay 101 occurs. At its upper contacts, relay 101 opens the circuit of relay 103 to thereby prevent resumption of the ringing operation when relay 102 restores.

At its lower contacts, line relay 101 open-circuits and extinguishes the call lamp L1, at the same time open-circuiting the slow-restoring call-supervisory relay 104. At the front contact of the lower armature of the line relay 101, ground potential on conductor 174 is extended, through contacts of call-supervisory relay 104, and contacts of recall key K4, to answer-supervisory relay 105. Relay 105 thereupon operates. At its upper contacts, relay 105 disconnects ringing relay 103 at an additional point to prevent resumption of ringing when the receiver is replaced and relay 101 restores; at its lower contacts relay 105 closes a self-locking circuit to conductor 174; and at its inner lower armature it disconnects transfer relay 106 from conductor 174 and connects it to a new circuit which includes conductor 174 and the front contact of the lower armature of line relay 101. Transfer relay 106 is maintained operated over this new circuit, and answering supervisory relay 105 remains operated in its locking circuit including its lower contacts.

Answer lamp L2 becomes lighted in parallel with answer-supervisory relay 105, whereby the operator is given positive answered supervision with respect to line 151.

The group-call operator may now converse with the subscriber at substation 161 and give him any desired information or instructions.

When the subscriber at the called 42-cycle substation 163 on line 152 responds, answer-test relay 112 operates momentarily (assuming that

the response occurs during a ringing period). Ringing relay 113 is consequently restored, whereupon line relay 111 operates over the called line. The operation of line relay 111 results in the operation of answer supervisory relay 115, through the front contact of the lower armature of line relay 111, and through contacts of the slow-restoring call supervisory relay 114. Relay 115 opens a further point in the circuit of ringing relay 113 at its upper contacts, while at its lower contacts it locks itself directly to conductor 174. Call supervisory lamp L3 becomes extinguished when disconnected at the lower contacts of line relay 111, and call supervisory relay 114 restores. Lamp L4 becomes lighted in parallel with relay 115 to give the operator answered supervision with respect to line 152.

In a similar way, the call lamp L5 of the line circuit LC—3 becomes extinguished and the answer lamp L6 becomes lighted when the subscriber at the called 66-cycle substation 169 on party line 153 responds.

Disconnect

When the subscriber at substation 161 on individual line 151 replaces his receiver, following his receipt of information or instructions from the group-call operator, the consequent restoration of line relay 101 results in the relighting of call lamp L1. Answer lamp L2 remains lighted under this condition in parallel with answer-supervisory relay 105 (locked up at the lower contacts thereof) as a reminder that the call over line 151 has been answered. The relighting of lamp L1 along with lamp L2 indicates to the group-call operator that the subscriber on line 151 has replaced his receiver.

As a further result of the restoration of line relay 101, transfer relay 106 restores (answer-supervisory relay 105 being in operated condition). Upon restoring, transfer relay 106 transfers the conductors of line 151 back to its regular switchboard terminals, including the jack J1 and its multiples, enabling the subscriber at substation 161 to make immediate use of his telephone line in the regular manner. If the subscriber at substation 161 is the fire chief, or someone else in a supervisory capacity, he may immediately make an outgoing call in the usual manner, to the fire station, for example.

When the subscriber at the called 42-cycle substation 163 on party line 152 replaces his receiver, the consequent restoration of line relay 111 results in call lamp L3 becoming relighted as a disconnect signal, answer lamp L4 remaining lighted. Similarly, call lamp L5 of line circuit LC—3 becomes relighted as a disconnect signal when the receiver is replaced at the called 66-cycle substation 169. The lines 152 and 153, however, remain connected respectively with line circuits LC—2 and LC—3, as the common transfer relay 116 is not affected by the restoration of the line relay in either of the latter line circuits.

Recall

Any one of the substations may be recalled after the receiver has been replaced, which is particularly desirable if, for example, the subscriber replaces the receiver before the group-call operator has given complete instructions, or if the group-call operator receives additional or changed instructions for one or more of the firemen.

To recall the individual line 151, the group-call operator need only momentarily operate re-

call key K4 of the line circuit LC—1, followed by an operation of the ringing key K1. When key K4 is momentarily operated, answer supervisory relay 105 restores and opens a further point in its previously existing locking circuit at its lower contacts. Transfer relay 106 is again connected to the grounded conductor 174, with the result that it is again operated to transfer line 151 back from its regular switchboard terminals to the line circuit LC—1. At the upper contacts of relay 105, the circuit of ringing relay 103 is again prepared, with the result that this relay may be operated under the control of ringing key K1 to again operate the ringer at substation 161.

Answer lamp L2 becomes extinguished when lower contacts of relay 105 are opened. Lamp L2 remains extinguished, and relay 105 remains restored, after the momentary operation of key K4 because the lower contacts of relay 105 have opened.

Call supervisory relay 104 is again operated (responsive to the reoperation of ringing relay 103) to lock itself operated at its inner contacts and to prepare a reoperating circuit at its lower contacts for answer-supervisory relay 105. As a result, the circuit conditions in line circuit LC—1 are identical with those existing during the initial ringing operation on the line 151 previously described.

When the recalled subscriber responds, line relay 101 is again operated to open-circuit ringing relay 103; to restore call supervisory relay 104; and to reoperate answer-supervisory relay 105. The call lamp L1 is again extinguished, and the answer lamp L2 becomes lighted again. The operator may now give the additional or changed instructions to the answering subscriber.

A momentary operation of the recall key K5 similarly enables the selected substation 163 on line 152 to be recalled. Relay 115 restores and lamp L4 becomes extinguished when the key K5 is momentarily operated. The circuit of ringing relay 113 is again prepared at the upper contacts of relay 115.

Clearing out

When a satisfactory response has been obtained on all lines of the called group, the operator may restore the talking key K2. When this occurs the ringing key K1 is disconnected from the line circuits, along with the conductors of the operator's telephone 100. At the lower contacts of key K2, ground potential is removed from conductor 174. By this operation any operated ones of the relays of the line circuits (such as 104, 105, and 106 of the line circuit LC—1) are restored, and any lighted ones of the supervisory lamps (such as L1 and L2) are extinguished. Transfer relay 116 also restores. The circuits are thus returned to their illustrated normal condition.

Operation of the system of Fig. 2

Referring now particularly to Fig. 2, let it be assumed that the system as illustrated therein is used to call firemen, for example. The operator is preferably instructed to communicate immediately with the supervisor at substation 263 upon receipt of a report of a fire. For this purpose, the operator may actuate the talking key K7, followed by actuation of the ringing key K6.

Calling the supervisor

Actuation of key K7 connects the conductors of the operator's telephone 200 to the talking conductors 275 and 276, extending through line circuit LC—6 to the supervisor's line 253. The call

buzzer B is disconnected by the key K7, and at the lower contacts of the key a lighting circuit for supervisory lamp L8 is established through contacts of line relay 211 of the line circuit LC—6.

When the ringing key K6 is operated a circuit is thereby closed, through contacts of the key K7, contacts of line and answer-test relays 211 and 222, for ringing relay 223. Upon operating, ringing relay 223 applies ringing current to line 253 from the 16-cycle ringing source 207.

When the supervisor responds, by removing the usual receiver (not shown) at substation 263, the resultant closure of a direct-current bridge across the conductors of line 253 permits answer-test relay 222 to respond. The circuit of ringing relay 223 is thereby temporarily interrupted. Relay 223 thereupon restores and reconnects line relay 211. Relay 211 energizes over line 253 and interrupts the circuit of ringing relay 223 at an additional point, thereby preventing resumption of the ringing operation.

At its upper contacts, line relay 211 disconnects ground potential from conductor 279, thereby extinguishing supervisory lamp L8 to give the operator answered supervision. The group-call operator and the supervisor may now converse over the established connection, through contacts of the talk key K7, over conductors 275 and 276, and line 253.

Upon being informed of the report, the supervisor may or may not instruct the group-call operator to call the volunteer firemen over the firemen lines, such as 251 and 252.

Making the group connection

Assuming that the supervisor instructs the group-call operator to call the firemen, the operator operates connect key K8, thereby extending connection to conductors 271 to 274 constituting the group-call line GC2. The operator's telephone 200 and the supervisor's substation set 263 are both thereby telephonically connected with the conductors 271 and 272 of the group-call circuit.

With line relay 211 in operated condition, ground potential on conductor 277 is now extended, through contacts of the connect key K8, to conductor 274 of group-call line GC2.

In the line circuit LC—4, the placing of ground potential on conductor 274 by the described operation of connect key K8 results in call lamp L9 becoming lighted, and in the operation of transfer relay 206 through contacts of answer-supervisory relay 205. Relay 206 transfers line 251 from its normal switchboard terminals through contacts of ringing relay 206, and through the illustrated individual talking condensers to talking conductors 271 and 272, now telephonically connected to operator's telephone 200 and substation 263, as pointed out.

Similar operations occur at the line circuit LC—5, including the lighting of call lamp L11, as well as at the other line circuits which may be interposed between line circuits LC—4 and LC—5 at the broken portion of conductors 271 and 274. It will be understood, of course, that the line relay is immediately operated at any line circuit to extinguish the call lamp in the event that the associated line is busy when transferred thereto as above described.

Ringing

When ringing key K6 is operated to signal the lines of the group, ground potential is extended through contacts of the key K7, and thence

through the inner contacts of the operated line relay 211, contacts of the key K8, to the common ringing conductor 273. From thence a circuit path extends to the ringing relay of each of the idle line circuits. The circuit of ringing relay 203 includes contacts of line relay 201, of answer-test relay 202, and of answer-supervisory relay 203. Responsive to the operation of relay 203, ringing current is applied to the associated line 251. Call-supervisory relay 204 responds to the operation of relay 203 by closing a locking circuit for itself in parallel with the lower contacts of relay 203. At its lower contacts relay 204 prepares a circuit for answer-supervisory relay 205.

Similar operations occur in the other line circuits, such as LC—5.

Response

When answering occurs at substation 261, and answer-test relay 202 consequently temporarily restores ringing relay 203, line relay 201 extinguishes call lamp L9, and it operates answer-supervisory relay 205 through contacts of the slow-restoring call supervisory relay 204. Relay 205 closes a locking circuit for itself at its lower contacts; disconnects ringing relay 203 at its upper contacts; and, at its inner lower armature, it transfers relay 205 into a new circuit including the front contact of the lower armature of line relay 201, enabling the line 251 to become disconnected from the group call circuit when the receiver is subsequently replaced thereon. Answer-supervisory lamp L10 becomes lighted in parallel with the winding of relay 205.

As the called firemen respond, they may receive their instructions from the supervisor at substation 263 or from the operator at telephone 200, or jointly from both. The operator may keep the supervisor informed of the condition of the lines as disclosed by the supervisory lamps, such as L9 to L12.

Recall

The line 251, for example, can be recalled following a momentary operation of recall key K9, with results as explained in connection with Fig. 1.

Disconnect

When a satisfactory response has been obtained from all the firemen, the supervisor at substation 263 may replace his receiver (not shown), whereupon line relay 211 restores. At its inner contacts line relay 211 disconnects ringing key K6 from key K8 and ringing conductor 273 of the group-call line GC2, again preparing a ringing circuit in the line circuit LC—6 over which the supervisor at substation 263 may be recalled in the discretion of the operator at telephone 200. At its upper armature, line relay 211 removes ground potential from conductor 277 and replaces it on conductor 276. As a result of the removal of ground potential from conductor 277, conductor 274 is deprived of ground potential, clearing out the line circuits such as LC—4 and LC—5. The placing of ground potential on conductor 278 by line relay 211 closes a lighting circuit for supervisory lamp L8, through contacts of the actuated key K7. Lamp L8 thereupon becomes lighted as a disconnect signal. The operator at telephone 200 is then expected to restore the keys K7 and K8.

Restoration of connect key K8 extinguishes hold lamp L7, while the restoration of key K7 extinguishes the supervisory lamp L8.

The supervisor calls

When the supervisor at station 263 removes his receiver (not shown) to originate a call, the resultant energization of line relay 211, in addition to preparing a ringing circuit over conductor 279 for the group-call line GC2, applies ground potential to conductor 277, thereby lighting supervisory lamp L8 as a call lamp and operating the call buzzer B, through contacts of the key K7 in normal condition. The operator at telephone 200 responds by actuating the key K7, thereby completing a talking circuit between telephone 200 and substation 263; preparing a ringing circuit from the ringing key K6 to the group-call circuit; disconnecting the call buzzer B; and extinguishing the supervisory lamp L8.

The supervisor may now instruct the operator at telephone 200 to call the firemen, which she may do by actuating the key K8, followed by desired actuation of the ringing key K6 as hereinbefore described.

I claim:

1. In a telephone system, subscriber lines each having its own terminals through which regular telephone service may be rendered, a group-call line having branches corresponding respectively to said subscriber lines, means controlled at will by a group-call operator for transferring each of said lines from its associated switchboard terminals to its associated branch of the group-call line, the group-call operator having a ringing key common to all said branches, means in each branch responsive to an actuation of said key for projecting ringing current over the associated transferred line, and means in each branch for preventing the said projection of ringing current so long as a receiver is off the hook at a substation on the associated subscriber line.

2. In a telephone system, subscriber lines each having its own terminals through which regular telephone service may be rendered, a group-call line having branches corresponding respectively to said subscriber lines, means controlled at will by a group-call operator for transferring each of said lines from its associated switchboard terminals to its associated branch of the group-call line, the group-call operator having a ringing key common to all said branches, means in each branch responsive to an actuation of said key for projecting ringing current over the associated transferred line, and means in each branch circuit responsive to the call over the associated subscriber line being answered for disabling the means therein for applying ringing current and for maintaining it disabled after the receiver has been replaced on the called line.

3. In a telephone system, subscriber lines each having its own terminals through which regular telephone service may be rendered, a group-call line having branches corresponding respectively to said subscriber lines, means controlled at will by a group-call operator for transferring each of said lines from its associated switchboard terminals to its associated branch of the group-call line, the group-call operator having a ringing key common to all said branches, means in each branch responsive to an actuation of said key for projecting ringing current over the associated transferred line, means in each branch circuit responsive to the call over the associated subscriber line being answered for disabling the means therein for applying ringing current and for maintaining it disabled after the receiver has been replaced on the called line, and recall means in each branch for enabling the group-call oper-

ator to recall the associated subscriber line after the called subscriber thereon has answered and again replaced his receiver.

4. In a telephone system, subscriber lines each having its own terminals through which regular telephone service may be rendered, a group-call line having branches corresponding respectively to said subscriber lines, means controlled at will by a group-call operator for transferring each of said lines from its associated switchboard terminals to its associated branch of the group-call line, each of the transferred lines being connected telephonically with the group-call line when transferred to its associated branch thereof, the group-call operator having a telephone connected with the group-call circuit enabling her to converse with any subscriber who has the receiver removed when his line is transferred, and supervisory means including signals individual respectively to said branches for informing the operator of the busy or idle condition of each of the transferred lines.

5. In a telephone system, subscriber lines each having its own terminals through which regular telephone service may be rendered, a group-call line having branches corresponding respectively to said subscriber lines, means controlled at will by a group-call operator for transferring each of said lines from its associated switchboard terminals to its associated branch of the group-call line, means for transmitting a call signal over each of said subscriber lines, means responsive to the removal of the receiver on one of said subscriber lines for terminating the signaling operation thereover, and means responsive to the subsequent replacement of the receiver for transferring the concerned subscriber line back to its own said terminals.

6. In a telephone system, subscriber lines each having its own terminals through which regular telephone service may be rendered, a group-call line having branches corresponding respectively to said subscriber lines, means controlled at will by a group-call operator for transferring each of said lines from its associated switchboard terminals to its associated branch of the group-call line, means for transmitting a call signal over each of said subscriber lines, means responsive to the removal of the receiver on one of said subscriber lines for terminating the signaling operation thereover, means responsive to the subsequent replacement of the receiver for transferring the concerned subscriber line back to its own said terminals, and recall means in the branch associated with the last-named line circuit for caus-

ing said line to be transferred again thereto and for again enabling said signaling means to signal thereover.

7. In a telephone system, subscriber lines each having its own terminals through which regular telephone service may be rendered, a group-call line having branches corresponding respectively to said subscriber lines, means controlled at will by a group-call operator for transferring each of said lines from its associated switchboard terminals to its associated branch of the group-call line, means for signaling on each of said subscriber lines, and means responsive to the replacement of the receiver after it has been removed on one of said lines in answer to said signaling for transferring such subscriber line back to its own said terminals.

8. In a line circuit for use between a group-call line and a subscriber line, a transfer relay for transferring the subscriber line from its regular switchboard terminals to the line circuit, a line relay operable over the transferred line when response occurs thereon, a supervisory relay responsive to the operation of said line relay, and circuit connections controlled jointly by said line and supervisory relays for causing said transfer relay to transfer said line back to its regular switchboard terminals when the line relay is restored at the end of the condition of response on the subscriber line.

9. In a line circuit for use between a group-call line and a subscriber line, means responsive to a call on said group-call line for transferring said subscriber line from its regular switchboard terminals to the group-call line by way of said line circuit, a pair of supervisory signals assigned to said line circuit, means for energizing the first of said signals dependent upon the transferred line being or becoming idle, means for calling over the transferred line when idle, and means dependent upon said call being answered for energizing the second of said signals.

10. In a group-call telephone system, normally separate subscriber lines, switchboard means comprising separate terminals for each of said lines through which regular telephone service may be rendered, a group-call line having branches corresponding respectively to said subscriber lines, a switching device, and means responsive to actuation of said device for disconnecting each of said subscriber lines from its associated switchboard terminals and transferring it to its associated branch of the group-call circuit.

GLENN KINER.