Dec. 4, 1945. R. H. CAMPBELL 2,390,203

COMMUNICATION SYSTEM

Filed Feb. 28, 1944 3 Sheets-Sheet 1

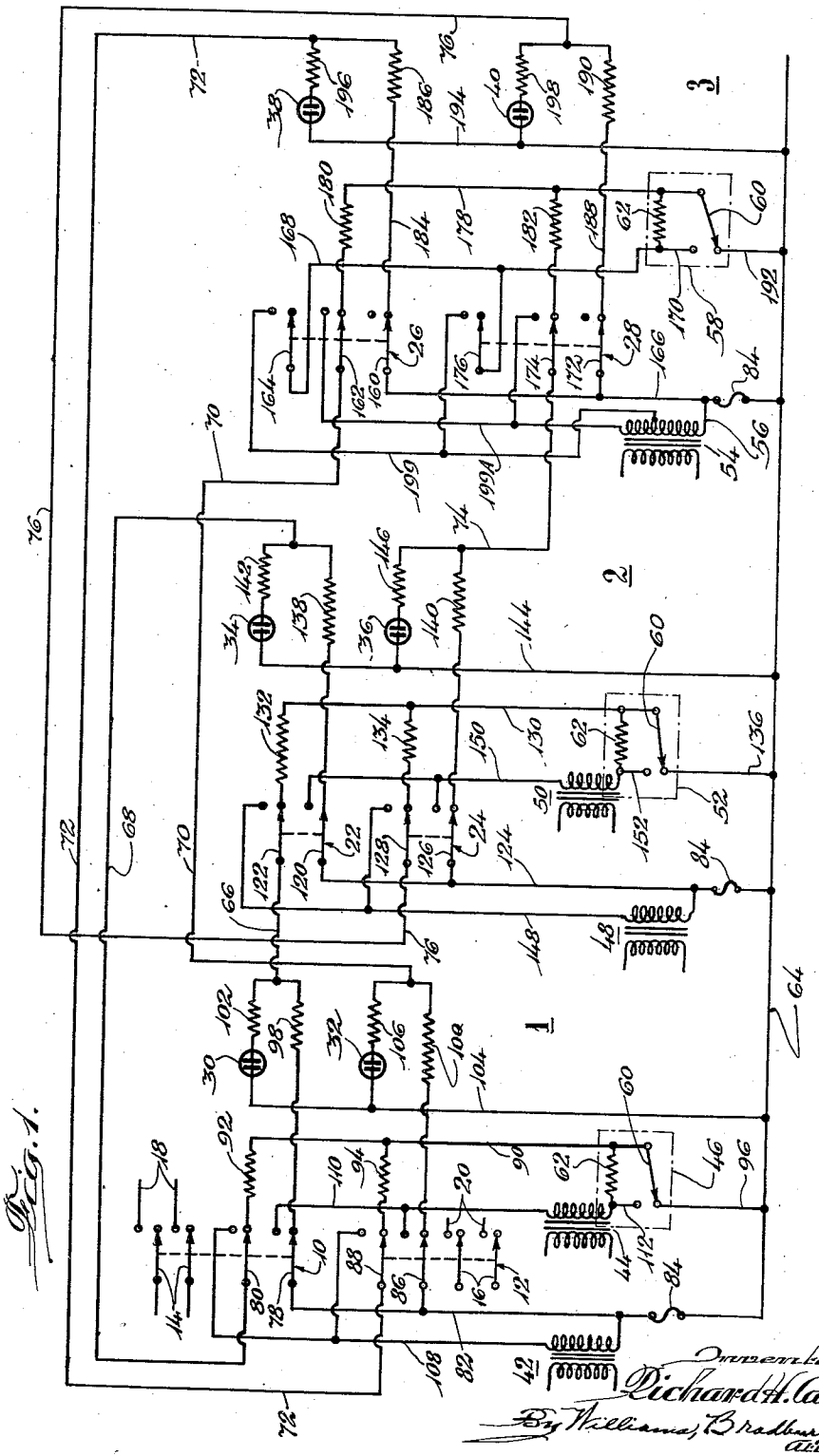

Fig. 1.

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COMMUNICATION SYSTEM

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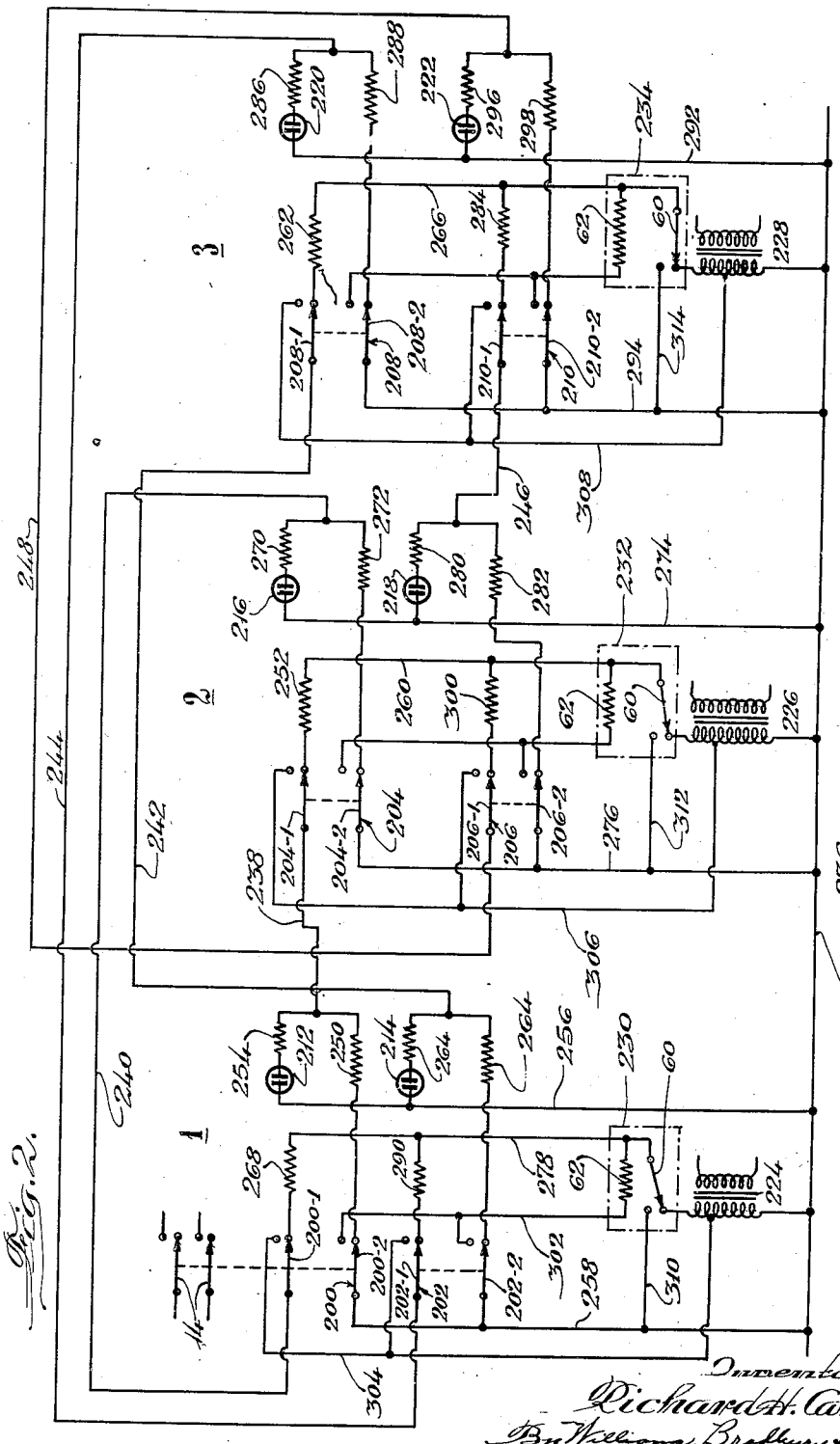

Fig. 2.

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COMMUNICATION SYSTEM

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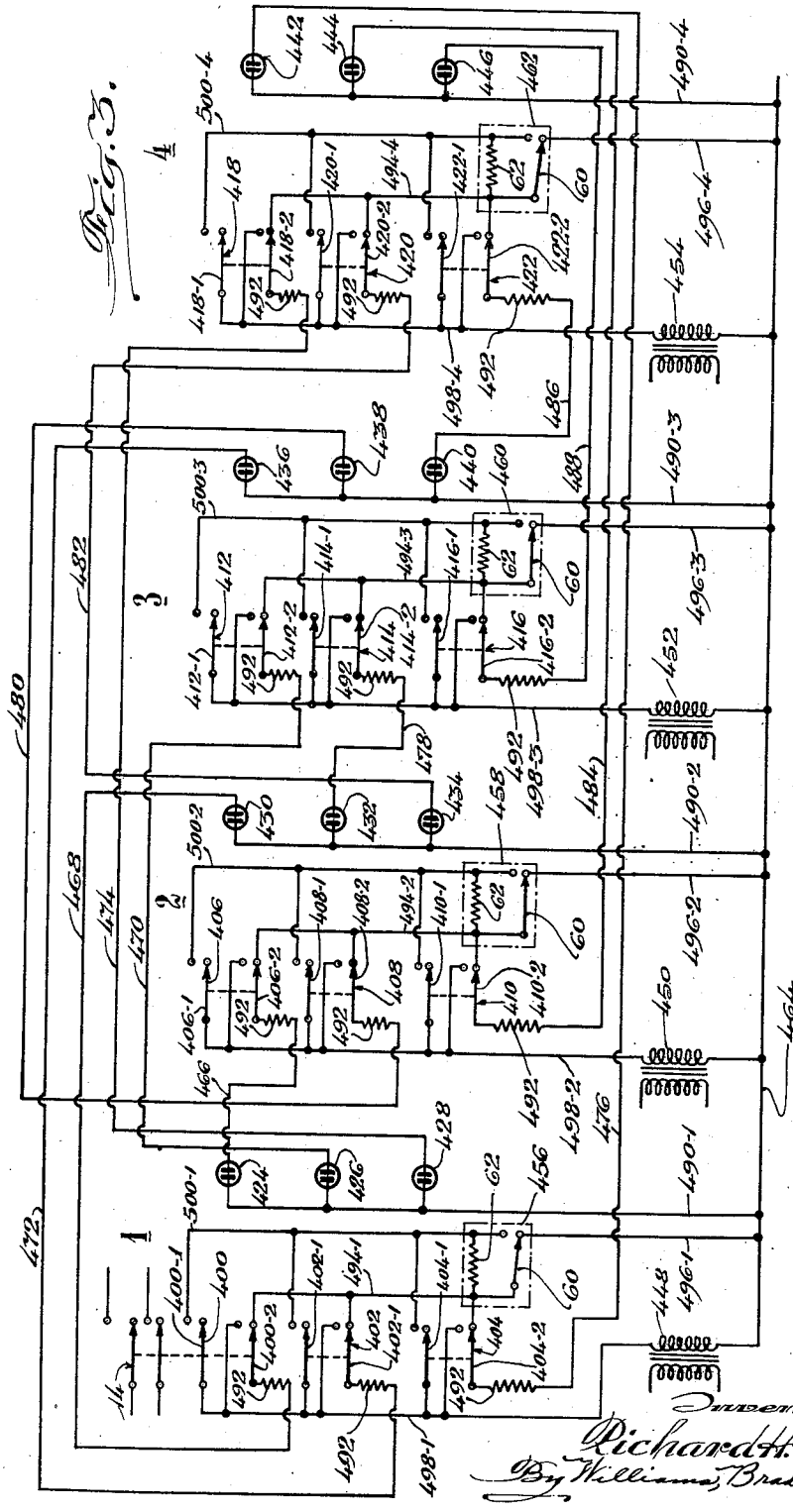

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2,390,203

COMMUNICATION SYSTEM

Richard H. Campbell, Racine, Wis., assignor to Webster Electric Company, Racine, Wis., a corporation of Delaware

Application February 28, 1944, Serial No. 524,178

32 Claims. (Cl. 179—37)

The present invention relates to intercommunicating systems and has for its primary purpose the provision of new and improved circuit arrangements for enabling an operator at one station to signal an operator at another, and also for operators at calling stations to obtain a signal as to whether or not the called station is busy or not busy.

Another object of the present invention is to provide communication systems with signaling arrangements whereby one station can signal another that it is desired to communicate therewith and wherein the calling station is given different distinctive signals in the event the called station is busy or not busy.

A further object of the present invention is the provision of a new and improved signaling arrangement wherein positive signals are produced at the calling station that the called station has been conditioned to answer the call.

A further object of the present invention is the provision of signaling arrangements of the character aforesaid which are inexpensive, avoid noise which may be produced by arrangements including relays, and wherein each of the stations of the system is a self-contained unit.

A further object of the present invention is the provision of signaling arrangements of the character aforesaid which are provided with protective fuses and wherein a pair of supply voltages at each station are connected in phase opposition, thereby to reduce the voltage on the system in the event a fuse is blown and to prevent the possibility of sneak currents from operating any of the signal lights under these conditions.

Other objects and advantages of the present invention will become apparent from the ensuing description, in the course of which reference is had to the accompanying drawings, in which:

Fig. 1 is a schematic representation of one embodiment of a signaling system for use with intercommunicating apparatus of the type wherein communication is carried on between stations in opposite directions over separate circuits, and which requires the closure of a selector switch in a transmission circuit to complete that circuit;

Fig. 2 is a similar representation of a modified embodiment of the invention; and

Fig. 3 is a schematic representation of a third embodiment of the invention.

Referring now to the drawings, and first to Fig. 1, it may be noted that the system illustrated therein consists of three stations, indicated by the reference characters 1, 2 and 3. The communication apparatus at the stations has not been illustrated for the reason that the present invention has to do with the signaling arrangements. The communication apparatus may be of any desired type and may be, for instance, of the type disclosed in my copending application Serial No. 457,549, filed September 7, 1942, now Patent No. 2,347,079, granted April 18, 1944, and assigned to the assignee of this application.

It is believed sufficient for the purposes of this application to say that each station may be provided with a microphone connected to the input of an amplifier, a loudspeaker, a transmission circuit, and a reception circuit, and, furthermore, with a communication direction control switch operable to condition the station for reception or transmission. The station is conditioned for reception by connection of the loudspeaker to the reception circuit, and the station is similarly conditioned for transmission by connection of the amplifier output to the transmission circuit which may be connected to the reception circuits individual to other stations by station selector switches.

In Fig. 1, station 1 is provided with two station selector switches 10 and 12, corresponding to stations 2 and 3, respectively. These switches include the pairs of switch blades 14 and 16 adapted to connect the transmission circuit (the output of the amplifier) to interstation circuits 18 and 20, also respectively, individual to stations 2 and 3 and constituting the reception circuits for these stations. The reception circuit for station 1 has not been illustrated, but when the station selector switch corresponding to a desired station has been closed, then communication may be carried on alternately in opposite directions over the reception circuit individual to station 1 and the transmission circuit for the other station upon alternate operation of the communictaion direction control switches at the two stations.

Stations 2 and 3 are also provided with a number of station selector switches corresponding to the number of other stations in the system, two in this case. Thus, station 2 is provided with the station selector switches 22 and 24 corresponding to stations 1 and 3, and station 3 is provided with the station selector switches 26 and 28 corresponding to stations 1 and 2. If the system included a larger number of stations, then stations in the system would be provided with a correspondingly increased number of station selector switches.

It may be noted that the station selector switches at station 3 are somewhat different from those at stations 1 and 2. The reason for this

will be described in some detail hereinafter. It may be noted also that the transmission circuit closing switch blades for the station selector switches at stations 2 and 3 have not been illustrated. This has been done in order to simplify a description and consideration of the present invention, which, as heretofore stated, has to do only with the signaling arrangements.

In accordance with the present invention, the various stations are each provided with a signal light corresponding to every other station in the system. Thus, station 1 is provided with signal lights 30 and 32 corresponding to stations 2 and 3, respectively; station 2 is provided with signal lights 34 and 36 corresponding to stations 1 and 3, respectively; and station 3 is provided with signal lights 38 and 40 corresponding to stations 1 and 2, respectively.

The signaling circuit of the present invention is so constructed and arranged that all the lights are deenergized or unlit when the system is not being used, i. e., none of the station selector switches is operated. When one station calls another and the called station is not busy, then the light at the called station corresponding to the calling station glows steadily, preferably, to show that the station is being called. The light at the calling station corresponding to the called station remains dark to show that the called station is not busy. When the called station answers, the lights corresponding to the two stations (one at each station) glow steadily. If a third station selects one of the two busy stations, or in the event one station selects a busy station at any time, the light at the calling station flashes periodically to show that the called station is busy. Even though the called station is busy, the light corresponding to the calling station thereat glows steadily to show that the station is being called.

Each of the stations is provided with its individual voltage supplies, and particularly voltage supplies for producing steady and flashing glow of the lamps. Station 1 is provided with a first transformer 42 providing a steady voltage, and a second transformer 44 coupled with a resistance type flasher unit 46 providing a periodic voltage for producing flashing operation of the lights. Station 2 is correspondingly supplied with transformers 48 and 50 and a flasher unit 52. Station 3, however, is provided with a single transformer 54 having a tapped secondary winding 56 to provide the two voltages. Station 3 is provided also with a resistance type flasher 58.

The resistance type flasher units are actually snap action switches operated by an expansible wire. The switches are indicated by the reference characters 60, and the corresponding wires by the reference characters 62. When the wires are unheated, they are of a definite length and hold the switches in the positions indicated in the drawings. When current passes through the wires they expand and the switch blades move into their uppermost positions. When this happens, the wires cool and the switches snap back into their indicated positions. The flashers may be of standard types available on the market, for instance, they may be of the type manufactured by the Tung-Sol Company of Newark, New Jersey.

All the stations in the system are connected by a number of interstation conductors, one of which is conductor 64, which may be termed a common conductor. Stations 1 and 2 are also connected by interstation conductors 66 and 68; stations 1 and 3 by interstation conductors 70 and 72; and stations 2 and 3 by interstation conductors 74 and 76.

Station selector switch 10 at station 1 includes the switch blades 78 and 80. The former is connected through conductor 82 to one terminal of the secondary winding of transformer 42 and to the common conductor 64 through a fuse 84. Blade 80 is connected to interstation conductor 68. Station selector switch 12 at station 1 includes the switch blades 86 and 88. The former is connected to conductor 82 and the latter to interstation conductor 72.

In the indicated position of the selector switches, switch blades 80 and 88 connect conductors 68 and 72 to a conductor 90 through resistors 92 and 94, respectively. Conductor 90 is connected to one terminal of the wire 62 and to switch blade 60, which normally connects conductor 90 to common conductor 64 through conductor 96. In the indicated position of the selector switches, switch blades 78 and 86 connect conductor 82 to resistors 98 and 100, respectively. Resistor 98 is connected to conductor 66 and resistor 100 to conductor 70.

Light 30 is connected in series with a resistor 102 across conductor 66 and common conductor 64 by a conductor 104. Light 32 is similarly connected across conductors 64 and 66 through the conductor 104 and resistor 106.

One terminal of the secondary winding of transformer 42 is connected by conductor 108 to contacts associated with switch blades 80 and 88, and one terminal of the secondary winding of transformer 44 is connected by conductor 110 to contacts associated with switch blades 78 and 86. The other terminal of the secondary winding of transformer 42 is connected to conductor 82 and to the common conductor through fuse 84. The other terminal of the secondary winding of transformer 44 is connected to wire 62 and by a conductor 112 to a contact associated with the switch blade 60, so that in the displaced position of the switch blade, the wire 62 is effectively short-circuited to enable it to cool.

Station selector switch 22 at station 2 includes a pair of switch blades 120 and 122. The former is connected to common conductor 64 through conductor 124 and a fuse 84. Blade 122 is connected to interstation conductor 66. Station selector switch 24 includes switch blades 126 and 128. The former is connected to conductor 124 and the latter to interstation conductor 76.

In the indicated positions of the selector switches at station 2, switch blades 122 and 128 connect conductors 66 and 76 to a conductor 130 through resistors 132 and 134, respectively. Conductor 130 is connected to one terminal of wire 62 and a switch blade 60 normally connecting conductor 130 to the common conductor through a conductor 136. Switch blades 120 and 126 connect conductor 124 to resistors 138 and 140, respectively. Resistor 138 is connected also to interstation conductor 68 and resistor 140 is connected to interstation conductor 74.

Light 34 is connected in series with a resistor 142 across conductors 64 and 68 by a conductor 144. Light 36 is similarly connected across conductors 64 and 74 through conductor 144 and a series resistor 146.

One terminal of secondary winding 48 is connected by conductor 148 to normally non-engaged contacts associated with switch blades 122 and 128, and the secondary winding of transformer 50 is similarly connected by conductor 150 to normally non-engaged contacts associated

with switch blades 120 and 126. The other terminal of the secondary winding of transformer 48 is connected to conductor 124 and to the common conductor through a fuse 84, while the other terminal of the secondary winding of transformer 50 is connected to expansible wire 62 and to a normally non-engaged contact of switch 60 by a conductor 152.

The selector switches at station 3 differ from those at stations 1 and 2 in that a tapped secondary winding 56 is used in place of two transformers; a change requiring the use of an additional switch blade on the station selector switches, as will become apparent shortly.

Station selector switch 26 at station 3 includes the switch blades 160, 162 and 164. Switch blade 160 is connected to the common conductor 64 through conductor 166 and fuse 84. Switch blade 162 is connected to interstation conductor 70. Switch blade 164 is connected by conductor 168 to one terminal of wire 62 and by branch conductor 170 to the normally non-engaged contact associated with switch 60.

Station selector switch 28 at station 3 includes the three switch blades 172, 174 and 176. Switch blade 172 is connected to conductor 166 and through fuse 84 to the common conductor 64. Switch blade 174 is connected to interstation conductor 74, and switch blade 176 is connected to the previously mentioned conductor 168.

In the indicated position of the selector switches at station 3, switch blades 164 and 176 are in circuit opening position; switch blades 162 and 174 connect conductors 70 and 74 to a conductor 178 through resistors 180 and 182, respectively; switch blades 160 and 172 connect conductor 166 to interstation conductors 72 and 76 through conductor 184 and resistor 186, and conductor 188 and resistor 190, respectively. Conductor 178 is connected to one terminal of wire 62 and the switch blade 60 normally connecting conductor 178 to the common conductor 64 through a conductor 192.

Light 38 is connected across conductors 64 and 72 through conductor 194 and resistor 196. Light 40 is connected across conductor 64 and conductor 76 through the conductor 194 and a resistor 198.

Power at station 3 is supplied by the transformer 54 having a tapped secondary winding 56. The tapped portion corresponds to transformers 42 and 48 at stations 1 and 2. It is connected by conductor 199 to the normally non-engaged contacts associated with switch blades 164 and 176. The full winding corresponds to transformers 44 and 50 at stations 1 and 2 and it is connected by conductor 199A to the normally non-engaged contacts associated with switch blades 162 and 174.

As heretofore indicated, all the lights in the system are normally deenergized; when one station calls another and the other is not busy, then the light at the first station corresponding to the second remains deenergized while the light at the second corresponding to the first glows steadily; when the second answers the first, the above specified lights at both stations glow steadily; and when a third station selects one of the two busy ones, the light at the third station corresponding to the called station flashes periodically to indicate that the called station is busy and the light at the called station corresponding to the calling station glows steadily.

Under normal conditions both terminals of all lights are connected to the common conductor so that no voltage is applied across them. The connections of the lights at this time are the same, and, therefore, only the connection of light 30 at station 1 will be described in detail. At station 1 one terminal of this light is connected to common conductor 64 through conductor 104 and the other terminal is connected to conductor 64 at station 2 through resistor 102, interstation conductor 66, switch blade 122, resistor 132, conductor 130, switch blade 60, and conductor 136. Resistor 98 is normally connected in parallel with the series connected light 30 and resistor 102 through switch blade 78, conductor 82 and fuse 84.

When one station calls another that is not busy, the light at the calling station remains deenergized, and the light at the called station is continuously energized and glows steadily. This operation will be described in connection with a call from station 1 to station 2. For station 1 to call station 2, it is necessary that the station selector switch 10 be operated to its displaced position. This operation effects the closure of switch 14, thereby to complete the connection of the transmission circuit to the reception circuit 16 individual to station 2. It also effects the connection of light 34 at station 2 (which corresponds to station 1) to the secondary winding of transformer 42 so that the light 34 glows. The energizing circuit for light 34 extends from one terminal of the secondary winding of transformer 42 to the other through the following circuit: conductor 108, switch blade 80 in its displaced position, conductor 68, resistor 142, light 34, conductor 144, conductor 64, and fuse 84. Resistor 138 is at this time parallel to the light 34 and resistor 142, but the light is energized sufficiently to be lighted because of the parallel connection. The operation of selector switch 10 also removes from circuit, at station 1, resistor 98 normally connected parallel to light 30 and resistor 102, but this does not affect the energization of light 30.

The operation of selector switch 10 also results in the periodic energization of conductor 72 so that if a station other than the called station selects station 1, the calling station will be given a flashing signal to indicate the station is busy. This operation will be described in detail hereinafter.

When station 2 responds to the call, selector switch 22 is operated into its displaced position, thereby to effect the energization of light 30 at station 1, so that it, too, glows steadily. The light 30 is connected across the secondary winding of transformer 48 through the following circuit: conductor 148, switch blade 122 in its displaced position, conductor 66, resistor 102, light 30, conductor 104, and the common conductor 64. Operation of switch 22 also removes from circuit the parallel connected resistor 138, but this does not affect the energization of light 34. As a result, when two stations (or more) are connected together for communication, the lights at the stations thus connected glow steadily.

Operation of selector switch 22 also effects operation of the flasher unit 52 periodically to energize conductor 76 so that should station 3 select it, the light 40 at station 3 corresponding to station 2 would flash periodically.

It may be worth while to mention that when the selector switch 22 at station 2 is operated, the reception circuit individual to station 1 is connected to the transmission circuit of station

2. Thereafter, communication may be carried on between the stations, as, for instance, by alternate operation of communication direction control switches at the two stations, pursuant to the disclosure of my copending application Serial No. 457,549. If desired, the system may be arranged so that communication may be carried on after closure of the station selector switches without subsequent manipulation of any communication direction controlling switches.

If a third station should select one of the two stations that are in communication with each other, then the light at the third station corresponding to the called station flashes periodically, whereas the light at the called station corresponding to the calling station glows steadily to indicate that another station desires to communicate with it.

When a station selector switch is operated at any station, for instance, the station selector switch 10 at station 1, a voltage is periodically applied to conductors leading to station 1 lights at stations other than the selected one (here conductor 72) by the resistor type flasher (here switch 46). When the switch 10 is operated, a circuit is completed through the wire 62, and when the latter becomes heated, the switch 60 is snapped into its displaced position to short-circuit wire 62. The wire then cools and switch blade 60 returns to its initial position. The wire 62 is energized in the indicated position of switch 60 by connection across the secondary winding of transformer 44 through the following circuit: conductor 110, switch blade 78 in its displaced position, conductor 82, fuse 84, conductor 64, conductor 86, and switch blade 60. When the switch blade 60 is in its indicated position, no voltage is applied to interstation conductor 72 as it is connected to conductor 64 through switch blade 88, resistor 94, conductor 90, switch blade 60, and conductor 96. However, when the switch blade is in its displaced position, secondary winding of transformer 44 is connected across interstation conductor 72 and the common conductor 64.

When the station selector switch 26 at station 3, corresponding to station 1, is in its indicated position, the light 38 at station 3 does not glow even though it is connected to conductor 72 and conductor 72 is periodically supplied with voltage. This results from the parallel connection of light 32 and resistor 196 with resistor 186 and the series connection of this parallel circuit with resistor 94 across the secondary winding of transformer 44. However, when switch 26 is operated at station 3 to call station 1, then the resistor 186 is removed from circuit and the secondary winding of transformer 44 is connected across a series circuit including resistor 94, conductor 72, resistor 196 and the light 38. As a result, an increased voltage is placed across the light sufficient to effect its energization, which is periodic because of the periodic application of voltage to conductor 72.

When station 3 selects station 1 by operation of selector switch 26, light 32 at station 1 is continuously energized and glows steadily. The light is connected across the secondary winding 56 through a circuit including conductor 199A, switch blade 162 in its displaced position, interstation conductor 70, the light 32 and resistor 196 connected in parallel with resistor 186, conductor 82, fuse 84 and the common conductor 64. At the same time the resistance flasher unit 58 is energized through the tapped portion of the secondary winding 56, the circuit including conductor 198, switch blade 164 in its displaced position, conductor 168, expansible wire 62, switch blade 60, conductor 182, common conductor 64 and fuse 84. Each time the expansible wire is short-circuited by switch 60 engaging conductor 178, the interstation conductor 74 leading from station 3 to station 2 is connected to the tapped portion of the secondary winding through the series resistor 182 so that voltage is applied to light 36 at station 2 (corresponding to station 3), but it is not energized sufficiently to glow.

The signal lights may be of any desirable form and they and the resistors may have any desirable values such as to provide the operation heretofore described. For instance, the lights may be of the neon tube type (as of the type NE 17 manufactured by the General Electric Company), resistors 92, 94, 132, 134, 180 and 182 may have values of about 2,000 ohms, resistors 182, 186, 142, 146, 196 and 198 may have values of about 1,000 ohms, and resistors 88, 190, 138, 140, 186 and 188 may have values of about 3,000 ohms.

The voltages across the secondary windings of transformers 42 and 44 and of transformers 48 and 50 are connected so that they are 180° out of phase. The secondary windings of transformers 42 and 48 may have a voltage of about 70 volts thereacross and the secondary windings of transformers 44 and 50 may have a voltage of 60 volts thereacross. Thus, if a fuse blows, with a selector switch operated, the two voltages, while connected together, produce only a voltage difference of 10 volts, thereby precluding the possibility that sneak currents in the circuit might operate some of the signal lights upon the blowing of a fuse.

While the foregoing description is limited to a system including three stations and the operation has been described in connection with station 1 calling station 2, station 2 answering station 1, and then station 3 selecting station 1, the operation is the same but for the circuits involved when different stations in the system originate calls. Furthermore, the system may include more than the three stations described.

In the embodiment of the invention illustrated in Fig. 2, the lights at the various stations are normally all deenergized. When the one station calls another, and the latter is not busy, the lights corresponding to the two stations both glow steadily, thus giving an indication at the called station that it is being called and an indication at the calling station that the called station is not busy. When the called station answers, the two lights remain energized. When a third station calls either one or the other of the two stations in communication with each other, the light at the third station corresponding to the called station flashes periodically while the light at the called station corresponding to the calling station glows steadily.

The system illustrated in Fig. 2 includes three stations indicated by reference characters 1, 2 and 3. The system may, however, comprise more stations, and the communication apparatus, which has not been illustrated, may take various forms, as set forth above in connection with the description of the apparatus of Fig. 1.

Each of the stations is provided with station selector switches corresponding to other stations in the system. Thus, station 1 is provided with station selector switches 200 and 202 corresponding to stations 2 and 3, station 2 with selector switches 204 and 206 corresponding to stations 1 and 3, and station 3 with selector switches 208

and 210 corresponding to stations 1 and 2. Each of the selector switches includes (in addition to the communication circuit controlling switch 14, shown only with switch 200) a pair of switch blades indicated by the reference character applied to the switch followed by the suffixes 1 and 2.

Each of the stations is also provided with signal lights corresponding to the other stations in the system. Thus, station 1 is provided with signal lights 212 and 214, station 2 with signal lights 216 and 218, and station 3 with signal lights 220 and 222. The stations are provided with transformers 224, 226 and 228, respectively, the secondary windings of which are of the tapped type. The stations are provided also with resistance type flasher units 230, 232 and 234, respectively, each of which includes a switch 60 and an expansible wire 62.

The system includes a number of interstation conductors as follows: a common conductor 236; conductors 238 and 240 between stations 1 and 2; conductors 242 and 244 between stations 1 and 3; and conductors 246 and 248 between stations 2 and 3.

Under normal conditions, when no station selector switches are operated, the lights of the system are deenergized. The light at each station corresponding to another station is normally connected to the secondary winding of the transformer at the other station, but it is not energized sufficiently to be lighted because it is connected in parallel with one resistor and in series with another resistor. Thus, the light 212 at station 1 is normally connected in parallel with a resistor 250, and the parallel connected resistor and light are connected in series with a second resistor 252. Incidentally, the light 212 is connected in series with another resistor 254, the light and resistor 254 being paralleled by the resistor 250. The light 212 and resistor 254 are connected across the conductors 236 and 238 by a conductor 256. Resistor 250 is normally connected across the same two conductors through the switch blade 200—2 and conductor 258. Conductor 238 is connected to resistor 252 through switch blade 204—1, and thence to secondary winding of transformer 226 through conductor 260 and switch 60.

Light 214 at station 1 corresponding to station 3 is similarly normally connected to the secondary winding of transformer 228 through the series resistor 262 and in parallel with a resistor 264. The resistor 264 is connected across conductors 236 and 242 by conductor 258 and switch blade 202—2. Resistor 262 is connected to conductor 242 by the switch blade 208—1 and to the transformer winding through conductor 266 and switch 60.

Light 216 at station 2 corresponding to station 1 is normally connected to the secondary winding of transformer 224 at station 1 through the series resistor 268, and it and its series resistor 270 are paralleled by the resistor 272. The light is connected across conductors 236 and 240 through the resistor 270 and conductor 274. The light 216 and resistor 270 are paralleled by the resistor 272, the parallel circuit including switch 204—2 and conductor 276. The energizing circuit for the light includes the interstation conductor 240, switch blade 200—1, the resistor 268, conductor 278, switch 60, and the common conductor 236.

Light 218 at station 2 corresponding to station 3 has associated with it a series resistor 280, the light and this resistor being connected in parallel with resistor 282, and this parallel circuit is connected to the secondary winding of transformer 228 at station 3 through the series resistor 284. Light 218 and resistor 280 are connected across conductors 236 and 246 through the previously mentioned conductor 274. Resistor 282 is connected across the same conductors through switch blade 206—2 and conductor 276. The circuit to the transformer winding includes conductor 246, switch blade 210—1, resistor 284, conductor 266, and switch 60.

Light 220 at station 3 corresponding to station 1 and its associated resistor 286 are normally connected in parallel with resistor 288, and the parallel circuit is connected to the secondary winding of transformer 224 at station 1 through interstation conductor 244 and a series resistor 290. Light 220 and resistor 286 are connected across conductors 236 and 244 through conductor 292. Resistor 288 is connected across the same conductors through switch 208—2 and conductor 294. The parallel circuit is connected to the secondary winding of transformer 224 through conductor 244, switch blade 202—1, resistor 290, conductor 278, and switch 60.

Light 222 at station 3 corresponding to station 2 and its associated resistor 296, which are connected in parallel with resistor 298, are normally connected to the secondary winding of transformer 226 at station 2 through interstation conductor 248, switch blade 206—1, resistor 300, conductor 260, and switch 60. Resistor 298 is paralleled with the light 222 and resistor 296 through a circuit including switch 210—2 and conductor 294.

Under normal conditions a periodic voltage is not applied to any of the interstation conductors, but when a selector switch at a station is operated, then a periodic voltage is applied to interstation conductors leading from that station to stations other than that for which the station selector switch was operated. Thus, when the station selector switch 200 at station 1 corresponding to station 2 is operated, the flasher switch 230 is rendered operative periodically to apply voltage to interstation conductor 244 leading to the station number 1 light 222 at station 3 (and similarly to other stations if more stations are included in the system).

When switch 200 is operated, the expansible wire 62 is connected across the secondary winding of transformer 224. The circuit includes conductor 258, switch 200—2 in its displaced position, conductor 302, the wire 62 and switch 60. It should also be noted that at the same time switch blade 200—1 connects the tapped portion of the secondary winding of transformer 224 to the interstation conductor 240 through conductor 304, so that the light 216 at station 2 is energized continuously and sufficiently to cause it to glow as a result of the elimination of the series resistor 268 from the energizing circuit for the light. Stations 2 and 3 are provided with conductors 306 and 308, respectively, to perform the functions performed by the conductor 304 at station 1. This operation will be described in greater detail hereinafter in a consideration of the operation of the system as a whole.

But, to return to the operation of the flasher, after the wire 62 has been energized for a certain length of time, the switch 60 is operated to its displaced position, thereby to short-circuit the wire. The wire is short-circuited by the switch 60 engaging a contact connected to conductor 310 leading to conductor 258. When

switch 60 is operated, the energizing circuit for light 220 is broken as a result of its being disconnected from the secondary winding of transformer 224. However, during the alternate periods when the light is connected to the transformer, it will not glow because resistors 288 and 290 are in the energizing circuit. Stations 2 and 3 are provided with conductors 312 and 314 corresponding to and performing the functions performed by conductor 310 at station 1.

Should station 3, however, select station 1 when the station selector switch 200 (corresponding to station 2) has been operated at station 1, then the light 220 at station 3 corresponding to station 1 will flash periodically. This results from the removal of the parallel circuit including resistor 288 from about the series connected light and resistor 286. The voltage across light 220 is thus increased to a value sufficient to energize the light during the periods when the circuit is completed to the secondary winding of transformer 224.

As already indicated, all the lights in the system are normally energized, but the energization (the voltage across the lights) is insufficient to cause the lights to glow. When one station calls another and the other is not busy, then the lights at both the calling and called stations glow steadily; when the second answers the first, the lights continue to glow steadily; and when a third station selects one of the two busy ones, the light at the third station corresponding to the called station flashes periodically to indicate that the called station is busy and the light at the called station glows steadily to show the call.

Under normal conditions the lights at stations corresponding to other stations are connected to the transformers at the other stations. However, the voltages across the lights are insufficient to cause them to glow, the lights being connected in parallel with resistors, and the parallel connected lights and resistors are connected across the transformer windings through series resistors. For instance, it will be recalled that the light 212 and its associated resistor 254 at station 1 are normally connected in parallel with resistor 254, and that the parallel circuit is connected to the secondary winding of transformer 226 at station 2 through the resistor 252. As a result, the voltage across light 212 is insufficient to cause it to glow. It is believed unnecessary to review in detail the similar connection of the other lights in the system in view of the previous detailed description of the connections.

When one station calls another that is not busy, the light at the calling station corresponding to the called station, and the light at the called station corresponding to the calling station, both glow steadily. This operation will be described in connection with a call from station 1 to station 2. For station 1 to call station 2, it is necessary that the station selector switch 200 be operated to its displaced position. This operation effects the closure of the communication circuit switch 14 and the disconnection from their respective circuits of the resistor 250 in parallel with light 212 and the resistor 288 which was in series with the parallel connected light 216 and resistor 272 at station 2. In addition, the parallel connected light 216 and resistor 272 are connected to the tapped portion of transformer 224 through switch blade 200—1 and conductor 304. The result is the continuous energization of the lights 212 and 216. At the same time the resistance flasher switch 230 is energized, as previously described in detail, periodically to connect interstation circuit 244 leading from station 1 to station 3 to the secondary winding of transformer 224, thereby to condition the system for the production of a flashing signal at station 3 should station 1 be selected thereat.

When station 2 responds to the call, station selector switch 204 at station 2 is operated. This removes from circuit the resistor 272 connected in parallel with light 216, and connects the light 212 at station 1 corresponding to station 2 directly to the tapped portion of the secondary winding of transformer 226 through switch blade 204—1 and conductor 306. Thus, both lights continue to glow continuously. At the same time the resistance flasher switch 232 is placed into operation for the periodic connection of conductor 248 to the secondary winding of transformer 226, so that should station 3 select station 2, a periodic flashing of the light 222 at station 3 would occur.

In the event station 3 should now select either station 1 or station 2, which are in communication with each other, then the light 220 or 222 corresponding to the called station would flash periodically. It will be remembered that conductors 244 and 248 are periodically connected to the secondary windings of transformers 224 and 226, respectively, by the flasher switches 230 and 232. Normally the lights 220 and 222, while connected to the conductors, are not energized sufficiently to glow because they are connected in parallel with resistors 288 and 298, respectively, and are connected to their respective transformers through the series resistors 290 and 300, respectively. However, assuming now that station 3 selects station 2, then station selector switch 210 at station 3 is operated to its displaced position. One result is the removal from circuit of parallel resistor 298 so that light 222 is supplied with a higher voltage resulting in its energization whenever the switch 60 at station 2 completes a circuit to the secondary winding of transformer 226. Thus, the light 222 flashes to indicate that station 2 is busy. Another result of the operation of selector switch 210 is the connection of light 218 at station 2 to the tapped portion of transformer 228 by switch blade 210—2, so that the light 218 at station 2 glows continuously to indicate to the operator at station 2 that station 3 is calling.

In the embodiment of the invention illustrated in Fig. 3, the signal lights are normally deenergized. When a first station calls another that is not busy, the light at the calling station corresponding to the called one remains dark, the light at the called station corresponding to the calling one glows steadily, and lights corresponding to the calling station at other stations in the system flash periodically. When the called station answers, the two lights at the two stations glow steadily, and lights at the remaining stations in the system corresponding to the two stations in communication with each other flash periodically. In the event another station selects a busy station, then the light at the busy station corresponding to the calling station glows steadily and the light at the calling station corresponding to the called station continues to flash periodically. The lights in the other stations of the system corresponding to the station which is calling the busy station also flash periodically.

Referring now to Fig. 3, it may be noted that the system herein illustrated includes four stations indicated by reference characters 1, 2, 3

and 4. Each is provided with station selector switches corresponding to other stations in the system. Thus, station 1 is provided with selector switches 400, 402 and 404 corresponding to stations 2, 3 and 4, respectively; station 2 is provided with selector switches 406, 408 and 410 corresponding to stations 1, 3 and 4, respectively; station 3 is provided with selector switches 412, 414 and 416 corresponding to stations 1, 2 and 4, respectively; and station 4 is provided with selector switches 418, 420 and 422 corresponding to stations 1, 2 and 3, respectively. Each of the switches includes a pair of switch blades indicated by the reference character applied to the switch followed by the suffixes 1 and 2, respectively. Each also includes a transmission circuit controlling switch like the one 14 shown in conjunction with switch 400 at station 1 and operable in the manner described in connection with the embodiment of the invention illustrated in Fig. 1.

Each of the stations in the system also includes a signal light corresponding to the other stations in the system. Thus, station 1 is provided with signal lights 424, 426 and 428 corresponding to stations 2, 3 and 4; station 2 is provided with signal lights 430, 432 and 434; station 3 with signal lights 436, 438 and 440; and station 4 with signal lights 442, 444 and 446.

Power is supplied to the signal circuits by transformers 448, 450, 452 and 454 at stations 1, 2, 3 and 4, respectively. The stations also include resistance type flasher units 456, 458, 460 and 462, respectively, each of which includes the switch 60 and the expansible wire 62.

The system also includes a number of interstation conductors, one of which is the common conductor 464, and others extending from the signal lights at the various stations to the stations corresponding to the signal lights. Thus, conductors 466 and 468 extend between stations 1 and 2; conductors 470 and 472 extend between stations 1 and 3; conductors 474 and 476 extend between stations 1 and 4; conductors 478 and 480 extend between stations 2 and 3; conductors 482 and 484 extend between stations 2 and 4; and conductors 486 and 488 extend between stations 3 and 4.

When no selector switches have been operated, the lights are all deenergized, both terminals of each light being connected to the common conductor 464. The circuits for thus connecting the lights to the common conductor each include a conductor 490—1, 490—2, 490—3, and 490—4, at the stations indicated by the suffix, the light, the corresponding interstation conductor, a series resistor 492 (all of which have been indicated by the same reference character for the purpose of simplicity), a selector switch blade having the suffix 2, a conductor 494 followed by the suffix corresponding to the station, the switch blade 60, and a conductor 496 followed by the suffix corresponding to the station.

When one station calls another, the secondary winding of the transformer at the calling station is connected to the interstation circuit leading to the light at the called station by the selector switch blade having the suffix 2, the connection to the transformer being effected through a conductor 498 followed by the suffix corresponding to the station. At the same time, the selector switch blade followed by the suffix 1 connects the resistance flasher unit to the transformer through a circuit including the conductor 500 followed by the suffix corresponding to the station.

In the operation of the system of Fig. 3 the lights are normally deenergized as both terminals of each is connected to the common conductor. When one station calls another and the other is not busy, then the light at the called station corresponding to the calling station glows steadily, while the light at the calling station corresponding to the called station remains dark. At the same time lights corresponding to the calling station at the other stations in the system flash periodically. When the second station answers the first, the light at the first station corresponding to the second also glows steadily, and the lights for both the calling and called stations flash periodically at other stations in the system. When a third station selects one of the two busy ones, the light at the third station corresponding to the busy one called continues to flash periodically while the light corresponding to the third station at the called busy station glows steadily. Lights at stations in the system other than the two busy ones and the third station, and corresponding to all three stations, flash periodically.

Under normal conditions, the lights at the stations have both terminals connected to the common conductor through similar circuits. For this reason it is deemed necessary to describe but one circuit and this will be done in connection with the light 424 at station 1 corresponding to station 2. One terminal of the light is connected to the common conductor 464 through conductor 490—1. The other terminal is connected to the common conductor through interstation conductor 466, resistor 492, switch blade 406—2, conductor 494—2, switch 60 and conductor 496—2.

When one station calls another that is not busy, the light at the called station corresponding to the calling station glows steadily, the light at the calling station corresponding to the called remains dark, and lights at the other stations in the system corresponding to the calling station flash periodically. Assuming that station 1 calls station 2, then station selector switch 400 is operated to its displaced position to connect light 430 at station 2 (corresponding to station 1) to the secondary winding of transformer 448 and also to energize the resistance flasher unit 456 so that lights 436 and 442 corresponding to station 1 at stations 3 and 4, respectively, will flash periodically. Light 430 is connected to the transformer through a circuit including conductor 498—1, switch blade 400—2, resistor 492, interstation conductor 468 leading to the light, conductor 490—2 and the common conductor 464. The flasher is energized through a circuit including the conductor 498—1, switch blade 400—1, conductor 500—1, the expansible wire 62, switch blade 60, conductor 496—1 and the common conductor 464. Wire 62 is thus heated but at this time no voltage is applied to interstation conductors 472 and 476 leading to lights 436 and 442, because they are connected to the common conductor. When switch 60 is operated as a result of the heating of wire 62, the wire is short-circuited and the secondary winding of transformer 448 is connected across lights 436 and 442. Light 436 is connected across the transformer through a circuit including conductor 498—1, switch blade 400—1, conductor 500—1, switch 60 in its displaced position, conductor 494—1, switch blade 402—1, resistor 492, interstation conductor 472 leading to the light 436, conductor 490—3 and the common conductor 464.

In similar manner the light 442 at station 4 corresponding to station 1 is energized through switch blade 404—2, resistor 492 and interstation conductor 476 leading to station 4.

When station 2 responds to the call, selector switch 406 is operated thereby to effect continuous energization of light 424 at station 1 corresponding to station 2, and also the periodic flashing of lights 438 and 444 at stations 3 and 4 corresponding to station 2. Light 424 is connected across the secondary winding of transformer 450 through a circuit including conductor 498—2, switch blade 406—2, resistor 492, the interstation conductor 466 leading to the light and conductors 490—1 and 464. The flasher 458 is energized through switch blade 406—1 and lights 438 and 444 at stations 3 and 4 are periodically connected to the secondary winding of transformer 450 through circuits including switch blades 408—2 and 410—2 in a manner deemed to be clear from the description of the operation of apparatus at station 1.

In the event station 3 should now select either station 1 or station 2, say station 2, then upon operation of station selector switch 414, light 432 at station 2 is energized continuously while lights 426 and 446 at stations 1 and 4 corresponding to station 3 flash periodically. The circuits for the steady and periodic energization of the lights are like those previously described and the circuits will, therefore, not be described in detail. It is believed sufficient to state that light 432 is energized through a circuit including switch blade 414—2 and interstation conductor 478. Flasher 460 is energized through switch blade 414—1 and periodic voltages are applied to lights 426 and 446 through circuits including switch blade 414—2 and interstation conductor 470, and switch blade 416—2 and interstation conductor 488, respectively.

From the foregoing detailed description of the invention, it may be noted that it has a number of advantages including those now about to be reviewed briefly. In the first place, all of the equipment, including the voltage supplies, are self-contained in the units at each station. Thus, installation of a station is greatly facilitated and a system may be made to include a desired number of stations with ease. The flasher type periodic voltage supply means does not include any relays, thereby minimizing expense and reducing excessive noise made by a relay. In apparatus of the character to which this invention pertains, the microphone is of necessity located quite close to the power supply and the use of a flasher type voltage supply reduces the noise level. Distinctive signals are produced at the calling and called stations and at other stations in the event a busy station is selected. A steady and positive signal is produced at the called station and when the calling station answers, a similar signal is produced at the station originating the call. Other stations are given different distinctive signals denoting that a station which they may desire to call is busy, thereby facilitating the ascertainment of the condition of any station in the system.

While only three embodiments of the invention have been described in detail, it should be understood that the details of the circuits are not to be construed as limiting the invention except insofar as set forth in the accompanying claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a multiple station intercommunicating system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, and means including signal light circuits between the stations and light circuit controlling switches operable with said selector switches constructed and arranged to produce intermittent glowing of the light at the selecting station and continuous glowing of the light at the selected station when a selector switch at the selecting station corresponding to the selected station and a selector switch at the selected station corresponding to some other station have been operated.

2. In a multiple station intercommunicating system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, and means including signal light circuits between the stations and light circuit controlling switches operable with said selector switches upon operation of the latter to select a station for producing steady glowing of the signal light at a selected station and for producing intermittent glowing of the light at the selecting station in the event a station selector switch corresponding to a station other than the selecting station has been operated at the selected station.

3. In a multiple station intercommunicating system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, a source of steady voltage at each station, a source of intermittent voltage at each station, and means including signal light and power circuits between the stations and circuit controlling switches operable with said selector switches upon operation of the latter to select a station for effecting the connection of the signal light at a selected station to a source of steady voltage and for effecting the connection of the light at the selecting station to a source of intermittent voltage in the event a station selector switch corresponding to a station other than the selecting station has been operated at the selected station.

4. In a multiple station intercommunicating system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, a source of steady voltage at each station, a source of intermittent voltage at each station, and means including signal light and power circuits between the stations and circuit controlling switches operable with said selector switches upon operation of the latter to select a station for effecting the connection of the signal light at a selected station to the source of steady voltage at the selecting station and for effecting the connection of the light at the selecting station to the source of intermittent voltage at the selected station in the event a station selector switch corresponding to a station other than the selecting station has been operated at the selected station.

5. In a multiple station intercommunicating system, the combination including, signal means at each station corresponding to other stations in the system, switch means at each station corresponding to other stations in the system, and means including signal circuits between the sta-

tions and circuit controlling switches operable with said switch means upon operation of the latter at a first station for effecting continuous operation of the signal means at a corresponding station in the event switch means at the corresponding station have not been operated and for producing intermittent operation of the signal means at the first station and continuous operation of the signal means at the corresponding station in the event switch means corresponding to a station other than the first station has been operated at the corresponding station.

6. In a multiple station intercommunicating system, the combination including, signal means at each station corresponding to other stations in the system, switch means at each station corresponding to other stations in the system, a source of steady voltage at each station, a source of intermittent voltage at each station, and means including signal and power circuits between the stations and circuit controlling switches operable with said switch means upon operation of the latter at a first station for connecting the signal light at a corresponding station to said source of steady voltage and for connecting the light at the first station to a source of intermittent voltage and the signal light at the corresponding station to said source of steady voltage in the event switch means corresponding to a station other than the first station has been operated at the corresponding station.

7. In a multiple station intercommunicating system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, a first and steady voltage source at each station, a second and periodic voltage source at each station, and means including signal and power circuits between the stations and circuit controlling switches operable with said selector switches upon operation of the latter to select a station for connecting the signal light at a selected station to the steady voltage source at the selecting station and effecting steady glowing thereof and for connecting the light at the selecting station to the second voltage source at the selected station and effecting periodic glowing thereof in the event a station selector switch corresponding to a station other than the selecting station has been operated at the selected station.

8. In a multiple station intercommunicating system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, a transformer winding providing a first and steady voltage source at each station, a transformer winding and a resistance type flasher unit at each station providing a second and periodic voltage source at each station, and means including signal and power circuits between the stations and circuit controlling switches operable with said selector switches upon operation of the latter to select a station for connecting the signal light at a selected station to the said first winding at the selecting station and effecting steady glowing thereof and for connecting the light at the selecting station to the second winding at the selected station and effecting periodic glowing thereof in the event a station selector switch corresponding to a station other than the selecting station has been operated at the selected station, said power circuits including a common conductor and said windings being connected thereto so as to be 180 degrees out of phase.

9. In a multiple station intercommunicating system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, a first and steady voltage source at each station, a second voltage source at each station normally connected to lights at other stations corresponding to the station, said connections including resistance means preventing glowing of the lights, each station including also means operable upon operation of the selector switches and associated with the second voltage source for producing a periodically recurring voltage, and means including signal, resistance means, and power circuits between the stations and circuit controlling switches operable with said selector switches to select a station for connecting the signal light at a selected station to the steady voltage source at the selecting station and effecting steady glowing thereof and for connecting the light at the selecting station to the periodically recurring voltage at the selected station and effecting periodic glowing thereof in the event a station selector switch corresponding to a station other than the selecting station has been operated at the selected station.

10. In a multiple station intercommunicating system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, a first and steady voltage source at each station, a second and periodically recurring voltage source at each station, said sources at each station including the same transformer winding, and means including signal and power circuits between the stations and circuit controlling switches operable with said selector switches upon operation of the latter to select a station for connecting the signal light at a selected station to said transformer winding at the selecting station and effecting steady glowing thereof and for periodically connecting the light at the selecting station to said transformer winding at the selected station and effecting periodic glowing thereof in the event a station selector switch corresponding to a station other than the selecting station has been operated at the selected station.

11. In signaling apparatus for use in communication systems of the type having station selector switches, the combination including, normally inoperative means adapted when rendered operative to produce a periodically recurring voltage, and switch means operable with said selector switches for rendering operative said voltage producing means when the selector switches are operated to select a station.

12. In signaling apparatus for use in communication systems of the type having station selector switches, the combination including, normally inoperative means adapted when rendered operative to produce a periodically recurring voltage, switch means operable with the selector switches normally connecting said voltage producing means to signal circuits, and other switch means operable with said selector switches for rendering operative said voltage producing means when the selector switches are operated to select a station.

13. In signaling apparatus for use in communication systems of the type having station selector switches and signal circuits, the combination in-

cluding, normally inoperative means adapted when rendered operative to produce a periodically recurring voltage, said means including a transformer winding having a pair of terminals, one of which is normally disconnected, an expansible wire connected to the other terminal of said winding, a conductor, and a two-position switch adapted normally to connect said wire to said conductor and operable upon heating of the wire to short-circuit the wire and disconnect the wire from said conductor, switch means operable with the selector switches normally connecting said conductor to the signal circuits, and other switch means operable with said selector switches for completing a circuit through said conductor, wire and winding when the selector switches are operated to select a station to effect periodic operation of said two-position switch and the periodic application of voltage to said signal circuits.

14. In signaling apparatus for use in communication systems of the type having station selector switches and signal circuits, the combination including, normally inoperative means adapted when rendered operative to produce a periodically recurring voltage, said means including a conductor, a transformer winding having a pair of terminals and a terminal tap, one of said terminals being connected to the conductor and said tap being normally disconnected, an expansible wire and a two-position switch connected to one terminal of the wire and adapted normally to connect said other terminal of the winding to the signal circuits and operable upon heating of the wire to connect the wire to said conductor and open the circuit to the winding, switch means operable with the selector switches normally connecting the said switch to signal circuits, and other switch means operable with said selector switches for connecting said wire to said conductor when the selector switches are operated to select a station to effect periodic operation of said two-position switch and the periodic application of voltage to said signal circuits.

15. In a multiple station communication system of the type wherein each station has station selector switches and signal lights corresponding to other stations in the system, the combination including, normally inoperative means at each station adapted when rendered operative to produce a periodically recurring voltage for energizing lights at other stations, and switch means operable with said selector switches for rendering operative said voltage producing means when the selector switches are operated to select stations.

16. In a multiple station communication system of the type wherein each station has selector switches and signal lights corresponding to other stations in the system, the combination including, normally inoperative means at each station adapted when rendered operative to produce a periodically recurring voltage for energizing lights at other stations, switch means operable with the selector switches normally connecting said voltage producing means to signal circuits connected to lights at other stations, and other switch means operable with said selector switches for rendering operative said voltage producing means when the selector switches are operated to select a station.

17. In a multiple station communication system of the type wherein each station has selector switches and signal lights corresponding to other stations in the system, the combination including, normally inoperative means at each station adapted when rendered operative to produce a periodically recurring voltage for energizing lights at other stations, said means including a transformer winding having a pair of terminals, one of which is normally disconnected, an expansible wire connected to the other terminal of said winding, a conductor common to all stations, and a two-position switch adapted normally to connect said conductor to said wire and operable upon heating of the wire to short-circuit the wire and disconnect the wire from said conductor, switch means operable with the selector switches normally connecting said conductor to signal circuits connected to lights at other stations corresponding to the station, and other switch means operable with said selector switches for completing a circuit through said conductor, wire and winding when selector switches are operated to effect periodic operation of said two-position switch and the periodic application of voltage to said signal circuits.

18. In a multiple station communication system of the type wherein each station has selector switches and signal lights corresponding to other stations in the system, the combination including, normally inoperative means at each station adapted when rendered operative to produce a periodically recurring voltage for energizing lights at other stations, said means including a conductor common to all the stations, a transformer winding having a pair of terminals and a terminal tap, one of said terminals being connected to the conductor and said tap being normally disconnected, an expansible wire, and a two-position switch connected to one terminal of the wire and adapted normally to connect said other terminal of the winding to signal circuits leading to other stations and operable upon heating of the wire to connect said wire to said conductor and open the circuit to the winding, switch means operable with the selector switches normally connecting said two-position switch to the signal circuits, and other switch means operable with said selector switches for connecting said wire to said conductor when the selector switches are operated to select a station to effect periodic operation of said two-position switch and a periodic application of voltage to said signal circuits.

19. In signaling apparatus for use in communication systems of the type comprising stations each having station selector switches and signal lights corresponding to other stations in the system, the combination including, normally inoperative means adapted when rendered operative to produce a periodically recurring voltage, a shunt resistor for each light, a light energizing circuit including a resistor adapted to be connected to lights at other stations, and switch means operable with the selector switches normally rendering said voltage producing means inoperative and connecting said resistor in shunt with respect to its associated light and operable when the selector switch is operated to render the voltage supplying means operative to supply said light circuits with periodically recurring voltage and to disconnect said resistor from the light.

20. In signaling apparatus for use in communication systems of the type comprising a plurality of stations each having station selector switches and signal lights corresponding to other stations in the system, the combination including, a shunt resistor for each light, light energizing circuits including a resistor and extending from stations to lights corresponding to the station at other stations, and switch means operable with the

selector switches normally connecting said shunt resistors in shunt with respect to its associated light and operable when the selector switch is operated to disconnect said shunt resistor from the light.

21. In signaling apparatus for use in communication systems of the type comprising stations each having station selector switches and signal lights corresponding to other stations in the system, the combination including, normally inoperative means adapted when rendered operative to produce a periodically recurring voltage, a shunt resistor for each light, a light energizing circuit including a resistor adapted to be connected to lights at other stations, and switch means operable with the selector switches normally rendering said voltage producing means inoperative and connecting said resistor in shunt with respect to its associated light and operable when the selector switch is operated to render the voltage supplying means operative to supply light circuits other than that corresponding with the operated selector switch with periodically recurring voltage, to disconnect said resistor from the light, and to supply the light circuit corresponding to the operated selector switch with a steady voltage.

22. In a multiple station communication system of the type wherein each station has station selector switches and signal lights corresponding to other stations in the system, the combination including, normally inoperative means at each station adapted when rendered operative to produce a periodically recurring voltage, a shunt resistor for each light, a light energizing circuit including a resistor extending from each station to lights corresponding to that station and other stations of the system, and switch means operable with the station selector switches normally rendering said voltage producing means inoperative and connecting a resistor in shunt with the light corresponding to the station corresponding to the station selector switch and operable when the selector switch is operated to render the voltage supplying means operative to supply light circuits with periodically recurring voltage and to disconnect the associated resistor from circuit with the associated light.

23. In multiple station communication systems of the type wherein each station includes station selector switches and signal lights corresponding to other stations in the system, the combination including, a shunt resistor for each light, a light energizing circuit including a resistor extending from each station to lights corresponding to the station at other stations in the system, and switch means operable with the selector switches normally connecting resistors in shunt to lights associated with stations corresponding to the selector switch and operable when the selector switch is operated to disconnect said resistor from circuit with the light.

24. In a multiple station communication system of the type comprising a plurality of stations each having station selector switches and signal lights corresponding to other stations in the system, the combination including, normally inoperative means at each station adapted when rendered operative to produce a periodically recurring voltage, a shunt resistor for each light, a light energizing circuit including a resistor adapted to be connected to lights corresponding to the station at other stations, and switch means operable with the selector switches normally rendering said voltage producing means inoperative and connecting an associated resistor in shunt to the light corresponding to the station associated with the selector switch, and operable when the selector switch is operated to render the voltage supplying means operative to supply light circuits other than that corresponding with the operative selector switch with periodically recurring voltage, to disconnect said resistor from the light, and to supply the light circuit corresponding to the operated selector switch with a steady voltage.

25. In a multiple station communication system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, and means including signal light circuits between the stations and light circuit controlling switches operable with said selector switches upon operation of the latter to select a station for producing intermittent glowing of the lights at stations other than the selected station.

26. In a multiple station communication system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, a voltage source at each station providing a periodically recurring voltage, and means including signal light and power circuits between the stations and circuit controlling switches operable with said selector switches upon operation of the latter to select a station for connecting the lights at stations other than the selected station to said voltage source.

27. In a multiple station communication system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, normally inoperative means at each station for providing a periodically recurring voltage, and means including signal light and power circuits between the stations and circuit controlling switches operable with said selector switches upon operation of the latter to select a station for rendering said voltage providing means operative and for connecting the lights at stations other than the selected station to said voltage providing means.

28. In a multiple station communication system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, and means including signal light circuits between the stations and light circuit controlling switches operable with said selector switches upon operation of the latter to select a station for producing steady glowing of the signal light at a selected station and for producing intermittent glowing of the lights at stations other than the selected station.

29. In a multiple station communication system, the combination including, signal lights at each station corresponding to other stations in the system, station selector switches at each station corresponding to other stations in the system, means providing a steady voltage at each station, normally inoperative means providing a periodically recurring voltage at each station connected to the lights corresponding to the station at other stations, and means including signal light and power circuits between the stations and circuit controlling switches operable with said selector switches upon operation of the latter at one station to select a station for connect-

ing the signal light at a selected station to the steady voltage providing means at the one station and for rendering operative the periodically recurring voltage providing means and for connecting the lights at stations other than the selected station thereto.

30. In a multiple station communication system, the combination including, signal lights at each station corresponding to other stations in the system station selector switches at each station corresponding to other stations in the system, and means including power supplying means and power and signal light circuits between the stations and power and light circuit controlling switches operable with the selector switches for producing a steady glow of the light at the called station corresponding to the calling station upon operation of the called station selector switch at the calling station and for producing a steady glow of the called station light at the calling station upon operation of the calling station selector switch at the called station, thereby to give a positive indication that the station selector switches at one station corresponding to the other have been operated.

31. In a multiple station communication system, the combination including, signal lights at each station corresponding to other stations in the system station selector switches at each station corresponding to other stations in the system, and means including power supplying means and power and signal light circuits between the stations and power and light circuit controlling switches operable with the selector switches for producing a steady glow of the light at the called station corresponding to the calling station upon operation of the called station selector switch at the calling station and for producing a steady glow of the called station light at the calling station upon operation of the calling station selector switch at the called station, thereby to give a positive indication that the station selector switches at one station corresponding to the other have been operated, said circuits and circuit controlling switches also being constructed and arranged to produce flashing of a light corresponding to a called one of the first two stations at another station when the station selector switch at the other station corresponding to one of said two stations has been operated to select it and steady glow of the light at the called one of the first two stations corresponding to the other station.

32. In signaling apparatus for use in communication systems of the type having station selector switches, the combination including, normally inoperative flasher type means adapted when rendered operative to produce a periodically recurring signal voltage, switch means operable with the selector switches normally connecting said voltage producing means to signal circuits individual to the selector switches, and means including other switch means operable with said selector switches for rendering operative said voltage producing means when the selector switches are operated to select a station, whereby said periodically recurring signal voltage is applied to signal circuits corresponding to non-operated selector switches.

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