

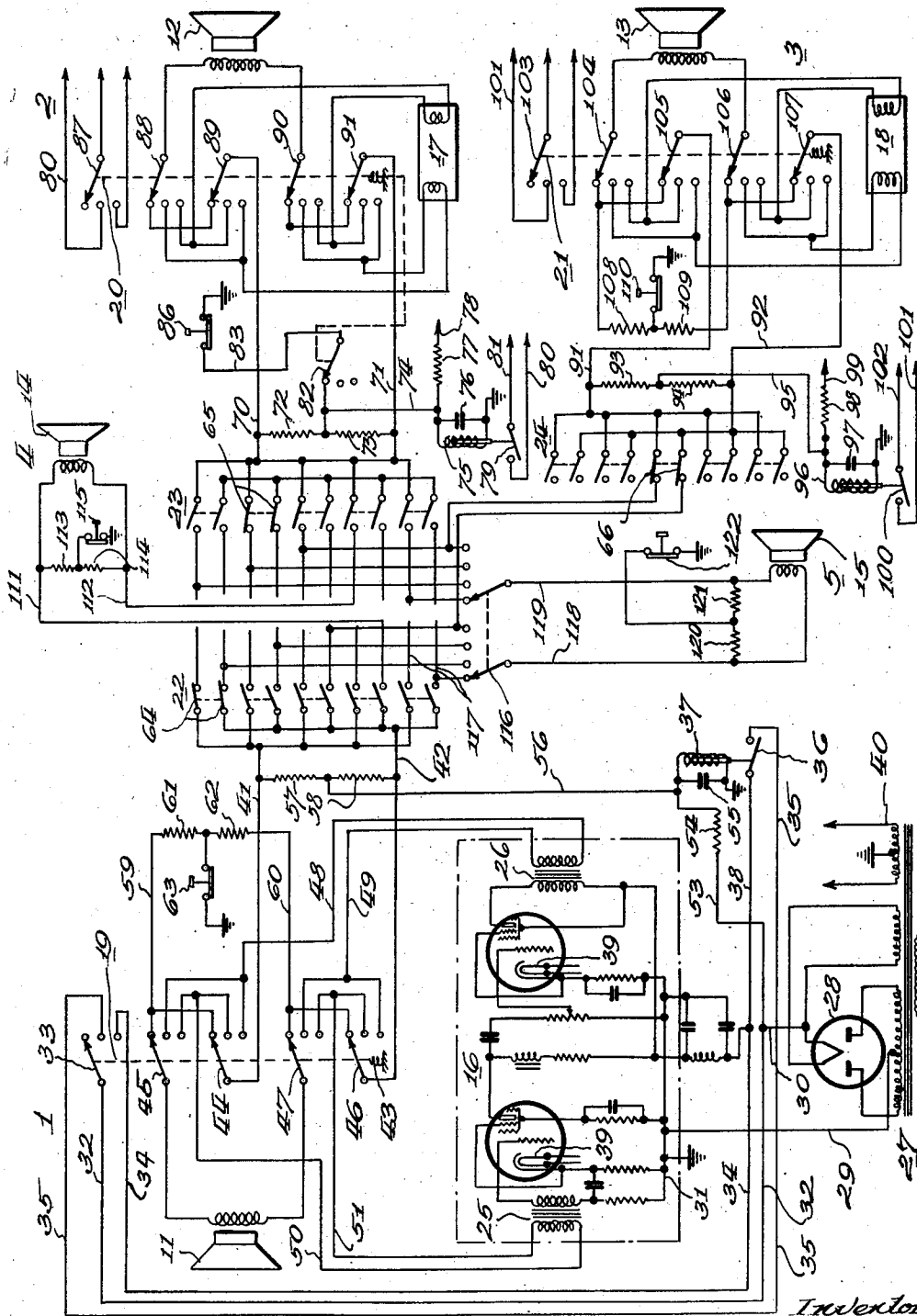
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COMMUNICATION SYSTEM

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COMMUNICATION SYSTEM

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The present invention relates to intercommunicating systems and more particularly to intercommunicating systems of the loudspeaking type employing amplifiers.

One well-known type of intercommunicating system comprises a number of stations, usually called central or master stations, each having an amplifier and loudspeaker used both as a receiver and a microphone, station selector switches, and a three-position communication control switch. In a first position, the idle-listen position, the loudspeaker is connected to an interstation circuit for reception of calls from other stations; in a second position, the listen-position, the loudspeaker is connected to the output and the interstation circuit to the input of the amplifier for reception of calls through the amplifier; and in a third position, the talk position, the connections of the interstation circuit and the loudspeaker to the amplifier are reversed. The communication control switch also controls the supply of "B" voltage to the amplifier. In the idle-listen position, the "B" supply is cut off to render the amplifier inoperative, but in the other positions, the "B" supply is connected to the amplifier to render it operative for use during reception and transmission.

In a system of the type described, it is possible for one station to "eavesdrop" on another by operating the communication control switch to its listen position and by operating a selector switch to select another station. When this is done, the loudspeaker at the one station is connected to the input and the loudspeaker at the other station to the output of the amplifier.

One of the objects of this invention is to provide a new and improved communicating system wherein "eavesdropping" is prevented and wherein one station can listen to another only when switch means at the latter are operated.

Another object of this invention is the provision of a new and improved system comprising one or more master stations and one or more sub-stations (stations provided with a loudspeaker adapted to be used both as a microphone and receiver but having no amplifier), wherein the master stations are prevented from eavesdropping on each other or upon the sub-stations.

A further object of the invention is to provide a new and improved communication system wherein the master station may be conditioned for reception of calls from sub-stations and the latter are provided with control means so connected in circuit with the amplifier that upon operation of the control means, a normally in-

operative amplifier at the master station is rendered operative so that the sub-station may call the master station.

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 drawing, the single figure of which represents schematically one embodiment of the invention.

Referring now to the drawing, there is illustrated an intercommunication system of the loudspeaking type wherein communication is carried on alternately in opposite directions between a plurality of master stations under the control of manually operable communication direction control switches and wherein communication may be carried on between a master station and one or more substations under the control of a communication direction control switch at the master station.

The master stations are indicated by reference characters 1, 2 and 3, and the sub-stations by reference characters 4 and 5. The stations are provided with translating devices capable of being utilized both as microphones and loudspeakers, such as loudspeakers 11 to 15, inclusive, which may be of the well-known permanent magnet type. The master stations 1, 2 and 3 are provided with amplifiers 16, 17 and 18, communication direction and power control switches 19, 20 and 21, and station selector switches 22, 23 and 24, all respectively.

The amplifiers may be of any well-known construction and from the figure it may be seen that only amplifier 16 at station 1 has been illustrated in detail. In brief, the amplifier comprises an input transformer 25 and an output transformer 26 inter-connected by two stages of amplification. Power is supplied from a suitable source of alternating current through a transformer 27 and in part through a rectifier tube 28. The supply of rectified current (the "B" supply) is directed to the amplifier through conductors 29 and 30, the former of which is connected directly to a common conductor 31 of the amplifier which is grounded preferably through the amplifier chassis, and the latter of which is adapted to be connected to the amplifier tubes through either of two circuits. The first circuit is completed when the communication control switch is operated to its lowermost or talk position, at which time the circuit extends from conductor 30 through conductor 32 and the uppermost switch blade 33 of the talk-listen switch 19 and conductor 34. The second of the two circuits is

completed when the switch blade 33 of the communication control switch is in its middle or listen position, at which time the circuit is completed through the conductor 32, the switch blade 33, a conductor 35, a switch blade 36, operable by a solenoid 37 in a manner to be described in greater detail hereinafter, and conductor 38.

It may be mentioned here, however, that the solenoid 37 is energizable to close switch 36 when the communication control switch 19 is in its listen position and switch means are operated at a selected master or sub-station, so that in the listen position of the communication control switch, the supply of "B" voltage to the amplifier is under the conjoint control of an operator at station 1 and an operator at a selected station. This conjoint control prevents the undesired "eavesdropping" referred to heretofore.

The amplifier is conditioned to be ready for instantaneous use whenever the "B" supply circuit is completed by reason of the fact that the cathode heaters 39 are continuously supplied with heating current from a secondary winding 40 of the transformer 27.

The communication direction and power control switch 19 is a manually operable multi-pole three-position switch. In a first position (the up and idle position), the loudspeaker 11 is connected directly to a communication circuit comprising conductors 41 and 42 for the reception of calls from other stations provided with amplifiers, that is, from other master stations. In a second position (the intermediate and listening position, as well as a position wherein calls may be received from sub-stations), the loudspeaker is connected to the output and the communication circuit to the input of the amplifier. In a third position (the down and talk position, from which the switch is biased by a spring 43 into its intermediate position upon release), the loudspeaker is connected to the input and the communication circuit to the output of the amplifier.

The connection of the loudspeaker to the communication circuit in the idle position of the communication direction control switch is as follows: from conductor 41 through switch blades 44 and 45 and from conductor 42 through switch blades 46 and 47. In passing, it may be noted that in the idle position of the switch, the "B" supply to the amplifier is disconnected as switch blade 33 is in circuit opening position.

The connection of the loudspeaker to the output and the communication circuit to the input of the amplifier in the intermediate position of the communication direction control switch is effected in the following manner: The loudspeaker 11 is connected to the output of the amplifier through switch blade 45 and conductor 48 and through switch blade 47 and conductor 49, the two conductors leading to the terminals of the secondary winding of the output transformer 26. Conductors 41 and 42 of the communication circuit are connected to the terminals of the primary of the input transformer 25 through switch blade 44 and conductor 50 and through switch blade 46 and conductor 51.

The connection of the loudspeaker to the input and of the communication circuit to the output of the amplifier in the third position of the communication direction control switch is effected in the following manner: The loudspeaker is connected to the input through switch blade 45 and conductor 50 and through switch blade 47 and conductor 51. The communication circuit is connected to the output of the amplifier through

switch blade 44 and conductor 48 and through switch blade 46 and conductor 49.

The solenoid 37, which controls in part the supply of "B" voltage to the amplifier in the listen position of the communication control switch, is deenergized when the communication control switch is in its idle position, as it is grounded through a circuit to be described shortly. The solenoid is supplied with energy from the rectifier through a conductor 53, connected to conductor 30, and a resistor 54 connected to one terminal of the solenoid, the other terminal of which is grounded. The solenoid is shunted by a current smoothing condenser 55. The previously referred to grounding circuit includes a conductor 56 connected to the ungrounded end of the solenoid, a pair of resistors 57 and 58, between which conductor 56 is connected, the communication circuit conductors 41 and 42, switch blades 44 and 46, conductors 59 and 60, the series connected resistors 61 and 62, and the normally closed grounding switch 63 of the push button type connecting to ground the point between resistor 61 and 62. The two pairs of resistors 56, 58, 61 and 62 are all of equal value so as to provide a balanced circuit. This balanced circuit prevents cross talk and undesirable hum that would otherwise result from uneven voltage (the voltage from the rectifier used in operating the solenoid) drops in the communication circuit.

The selector switch 22 at station 1 includes a number of switches, as, for instance, the two indicated by reference character 64, which are termed the station No. 1 switches and which are ordinarily maintained in closed position in order that other stations may communicate with station 1. Each of the master stations is preferably provided with as many pairs of switches as there are stations in the system so that each station may communicate with the others. Thus, the selector switch 23 at station 2 is illustrated as having the same number of switches as selector switch 21 and the switch blades 65 thereof are closed in order to connect station 2 to the system for reception of calls from other stations. The selector switch 24 at station 3 has not been illustrated in full, but it comprises the switches 66 which are normally closed to connect station 3 for reception of calls from other stations.

The control circuit at station 2 differs somewhat from that at station 1, but it is arranged to perform the same functions as that at station 1. The communication circuit conductors at station 2 are indicated by reference characters 70 and 71. Connected across these in series are resistors 72 and 73, corresponding to the resistors 57 and 58 at station 1. The junction of the resistors is connected through conductor 74 to one terminal of a solenoid 75, the other terminal of which is grounded. The solenoid is shunted by condenser 76 and supplied with energizing current from the "B" supply through resistor 77 and conductor 78. The solenoid controls a switch 79 adapted to interconnect conductors 80 and 81.

In the idle position of the communication direction control switch, the solenoid 75 is grounded through switch blade 82 forming part of the communication control switch 20, conductor 83, and a normally closed push button switch 86. The described construction eliminates the second pair of resistors 61 and 62 found at station 1.

The communication control switch 20 includes, in addition to the switch blade 82, switch blades

87, 88, 89, 90, and 91, which correspond, respectively, to switch blades 33, 45, 44, 47, and 46 of the communication direction control switch 19 at station 1. These switch blades are arranged in circuit and perform the same functions as the switch blades of the communication control switch at station 1, so that further description thereof is deemed to be unnecessary.

The apparatus at station 3 corresponds identically with that at station 1. In brief, the communication circuit comprises conductors 91 and 92, across which are connected in series the resistors 93 and 94. The junction of the resistors is connected by conductor 95 to a solenoid 96 which is shunted by a condenser 97. The solenoid is supplied with energy from the "B" supply through resistor 98 and conductor 99. The solenoid controls a switch 100 adapted to close a circuit between conductors 101 and 102. The communication control switch includes switch blades 103, 104, 105, 106, and 107, corresponding to switch blades 33, 45, 44, 47, and 46, respectively, of the switch 19 at station 1. In the listen position of the communication control switch, the solenoid 98 is grounded through a circuit including a second pair of resistors 108, 109 and a normally closed push button switch 110.

Station 4 is connected to a pair of conductors 111 and 112, and these in turn are connected to interstation conductors individual to station 4. A pair of resistors 113 and 114 are connected in series across conductors 111 and 112, and the junction of the resistors is connected to ground through a normally closed push button switch 115.

The apparatus at station 5 corresponds to that at station 4 except for a station selector switch 116, shown connecting the station to a pair of interstation conductors 117 individual thereto. The selector switch is connected to conductors 118 and 119 bridged by a pair of series connected resistors 120 and 121. The junction of the resistors is connected to ground through a normally closed push button switch 122.

In the operation of the system described above, it is contemplated that each of the amplifiers will normally be supplied with power from a suitable alternating current source through the transformers, and that the communication direction control switches at the various stations will be in their indicated or idle positions, at which time the solenoids at the respective stations will be grounded through circuits including the normally closed push button switches thereat. The station selector switches individual to the respective stations are closed so as to condition the stations for reception of calls from other stations.

It is assumed now that the operator at station 1 desires to call the operator at station 2. To do this, the operator at station 1 first closes the second pair of station selector switches thereat to interconnect conductors 70 and 71 with conductors 41 and 42, respectively, through switch 65 at station 2. This is followed by operation of the communication direction control switch 19 to its lowermost or talk position. Amplifier 16 is rendered operative as the "B" supply circuit is completed through conductor 32, switch blade 33, and conductor 34. The grounding circuit for solenoid 37 is broken at station 1 by reason of the movement of switch blades 45 and 47, thereby to disconnect resistors 61 and 62 and ground switch 63 from the solenoid. The solenoid, however, remains deenergized as it is connected to

ground through the interstation circuit and the switch blade 82 and push button switch 86 at station 2. However, the operator at station 1 can call station 2 because, when the communication control switch 19 is operated to its lowermost position, the amplifier is rendered operative as already described, loudspeaker 11 at station 1 is connected to the input of the amplifier, and loudspeaker 12 is connected to the output of the amplifier through circuits that have likewise been previously described.

In order for the operator at station 2 to answer, it is necessary that the communication control switch 19 at station 1 be released to return it to its intermediate or listen position, and it is also necessary for the operator at station 2 to open the push button switch 86, thereby to open the grounding circuit for solenoid 37. When this is done, the solenoid 37 is energized from the source of "B" voltage at station 1, and upon energization, it closes switch 36, thereby to complete the "B" supply circuit through this switch and through the switch blade 33 in its intermediate position. Inasmuch as the communication control switch in its listen position connects loudspeaker 11 at station 1 to the output of the amplifier and the interstation circuit to the input of the amplifier, the operator at station 2 can talk to the operator at station 1.

In the event the operator at station 2 desires to call the operator at station 1, the same procedure is followed, with the operator at station 2 performing those functions previously performed by the operator at station 1, and the operator at station 1 performing the functions previously performed by the operator at station 2, as described above.

One of the advantages of the foregoing arrangement is that the operator at station 1, when communicating with station 2, is unable to listen to another station, such, for instance, as station 4, by closing the selector switches for connecting that station to station 1. In the event that an attempt is made to do this, the solenoid 37 at station 1 is grounded through the normally closed push button switch at station 4, and, consequently, the amplifier "B" supply is broken by the switch 36, thereby rendering it impossible for the operator at station 1 to listen to any station, be it station 4 or one of the master stations, such, for instance, as station 3. This prevents eavesdropping and listening to other stations, except when the grounding switches at these other stations are open.

In the event station 1 desires to call station 4, the selector switch for the latter station is closed, and the communication control switch 19 operated to its talk position. This permits transmission from station 1 to station 4. Transmission in the reverse direction is possible when the communication control switch is released to its intermediate position and the grounding switch 115 at station 4 is opened.

The control switches at the master stations may be conditioned also for the reception of calls from sub-stations. This conditioning is effected by leaving the communication control switches, for instance, control switch 19 at station 1, in its intermediate position. At that time, the loudspeaker 11 at station 1 is connected to the output of the amplifier and the interstation circuit connected to the input. In the event station 1 is conditioned for reception of calls from station 4, then the amplifier at station 1 is inoperative as the solenoid 37 would be grounded

through push button switch 115. However, the amplifier is rendered operative whenever station 4 opens the grounding switch 115 to initiate a call. After a call has been received by station 1, communication may be carried on in opposite directions in the manner described above.

In the event station 1 is conditioned for reception of calls from stations, such as station 5, provided with selector switches, then the amplifier is normally operative as the solenoid 37 is ungrounded. However, when station 5 selects station 1, the amplifier is rendered inoperative until grounding switch 122 at station 5 is opened. Once opened, the amplifier is rendered operative in the same manner as though a call were originated from station 4.

In case the communication control switch of the master station, such as station 1, is left in the intermediate or listen position, other master stations may call station 1 simply by closing the proper station selector switch and opening the grounding switch, such, for instance, as switch 86 at station 2 or switch 110 at station 3. The operation in this event is the same as though a call were originated from one of the sub-stations.

While only a few stations have been shown in the embodiment of the invention illustrated and described, it should be understood that the number may be varied as desired, and although the invention has been disclosed with the specific details of a preferred embodiment, it should be understood that such details are not intended to be limitative of the invention except in so far 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, an amplifier at each station, means including a combined amplifier power and communication direction control switch at each station operable to a predetermined position for conditioning the station for reception through the amplifier and partly completing a circuit for rendering the amplifier operative, switch means at each station for completing said circuit, and means including other switch means at each station for effecting closure of said first mentioned switch means and rendering operative the amplifier at a station at which the control switch is in said predetermined position.

2. In a multiple station intercommunicating system of a type wherein a pair of stations are adapted to be connected for two-way communication over a single circuit, the combination including, an amplifier at one of said stations, combined communication direction and amplifier energization controlling switch means and circuits controlled thereby at said station for connecting said station for reception through said amplifier and for partly completing an energizing circuit for said amplifier, and means including a switch at another station for completing said energizing circuit.

3. In a multiple station intercommunicating system of a type wherein a pair of stations are adapted to be connected for two-way communication over a single circuit, the combination including, an amplifier at one of said stations conditioned for immediate operation upon connection thereof to a source of "B" voltage, a source of "B" voltage, combined communication direction and amplifier energization controlling switch

means and circuits controlled thereby at said station for connecting said station for reception through said amplifier and for partly completing the "B" supply circuit for said amplifier, and means including a switch at another station for completing said "B" supply circuit.

4. In a multiple station intercommunicating system of a type wherein a pair of stations are adapted to be connected for two-way communication over a single circuit, the combination including, an amplifier at one of said stations, switch means and circuits controlled thereby at said station for connecting said station for reception through said amplifier and for partly completing an energizing circuit for said amplifier, and means including a solenoid and a switch controlled thereby operable to complete said energizing circuit, and a normally closed switch grounding said solenoid at another station operable to an open position for completing said energizing circuit.

5. In a multiple station intercommunicating system of a type wherein a pair of stations are adapted to be connected for two-way communication over a two wire interstation circuit, the combination including, loudspeakers utilizable as microphones and receivers at each station, an amplifier at one of said stations, switch means and circuits controlled thereby at said station for connecting the loudspeaker thereat for reception through said amplifier and interstation circuit and for partly completing an energizing circuit for said amplifier, and means for completing said energizing circuit from another station, said last mentioned means including a pair of resistors connected in series across said interstation circuit at each station, a solenoid connected to a source of power and a point between the pair of resistors at said one station, a switch controlled thereby and operable upon energization of said solenoid to complete said amplifier energizing circuit, and a normally closed grounding switch connected between the pair of resistors at said other station.

6. In a multiple station intercommunicating system, the combination including, an amplifier at each station, means including a combined amplifier power and communication direction control switch at each station operable to a predetermined position for conditioning the station for reception through the amplifier and partly completing a circuit for rendering the amplifier operative, a solenoid and a switch controlled thereby operable upon energization of the solenoid to complete said circuit, and means including other switch means at each station grounding said solenoid and operable to remove the ground and thereby energize said solenoid and render operative the amplifier at a station at which the first mentioned switch is in said predetermined position.

7. In an intercommunicating system of the loudspeaking type, comprising a number of stations each having an amplifier with input and output connections, a loudspeaker utilizable both as a receiver and a microphone, station selector switches for connecting the station to interstation communication circuits and a communication direction and power control switch operable in one position to connect the loudspeaker to an interstation circuit through a station selector switch for reception of calls from other stations, in a second position to connect the loudspeaker to the output and an interstation circuit to the input of the amplifier, and in a third position to

reverse the connections of the loudspeaker and interstation circuit to the amplifier, the combination including, circuits controlled by each control switch for rendering the amplifier associated therewith inoperative in said first position, for conditioning for completion a circuit to render the amplifier operative in said second position, and for rendering operative the amplifier in said third position, a solenoid normally connected to a source of power at each station, a switch controlled thereby for completing the amplifier energizing circuit when the control switch is in said second position, and a circuit including a normally closed switch for grounding the solenoid through a portion of an interstation circuit when the communication control switch is in said first position, whereby stations with their control switches in their first positions may be called by other stations upon operation of the communication control switches at the latter to their third positions and the called stations may answer upon the calling station operating the control switch thereat to its second position and upon opening the normally closed switch to energize the solenoid and thereby complete the energizing circuit for the amplifier.

8. A system according to claim 7, comprising, in addition, a number of stations provided with loudspeakers utilizable both as microphones and receivers, and normally closed switches for grounding the interstation circuit, whereby, when the control switches at stations of the first type are left in their second positions, the substations may transmit messages thereto upon opening of the normally closed switches thereat.

9. In an intercommunicating system, as claimed in claim 7, wherein resistors are connected across the interstation lines at each station and the solenoids are connected to the junction of said resistors and wherein said junctions are grounded through the normally closed switches when the communication control switches are in their first positions.

10. In a multiple station intercommunicating system, the combination including, a first station, an amplifier thereat, means including a combined amplifier power and communication direction control switch at said station operable to a predetermined position for conditioning the station for reception through the amplifier and partly completing a circuit for rendering the amplifier operative, a normally open switch thereat for completing said circuit, means operable to close said switch, a second station, and means including switch means at said second station for causing said last mentioned means to close said switch when the first mentioned switch at the first station is in said predetermined position.

11. In a multiple station intercommunicating system, the combination including, a first station, an amplifier thereat, means including a combined amplifier power and communication direction control switch at said station operable in one position to condition the station for reception through the amplifier and an interstation circuit and partly to complete an energizing circuit for the amplifier and operable to a second position for conditioning the station for transmission of messages through the amplifier and an interstation circuit, and a switch thereat for completing said amplifier energizing circuit when the switch is in said one position, a solenoid for operating said switch, a source of power

to which said solenoid is connected, a pair of resistors connected across an interstation circuit, a connection from said solenoid to the junction of said resistors, a second station, a pair of resistors connected across the intercommunication circuit terminating at said second station, and a normally closed grounding circuit for said solenoid connected to the junction of said resistors, whereby said second station may call the first upon opening of said grounding circuit to cause the solenoid to close the switch controlled thereby and whereby the first station may call the second station by operating the communication control switch thereat to its second position.

12. A unit for use in an intercommunicating system, including in combination, an amplifier, a loudspeaker, a circuit adapted to be connected to other stations, means including a communication control switch operable to a predetermined position to connect said loudspeaker to the output and said circuit to the input of said amplifier, an energizing circuit for said amplifier partly completed by said control switch when in said predetermined position, a switch for completing said energizing circuit, and means connected to said circuit and controllable through said circuit for controlling said switch.

13. A unit for use in an intercommunicating system, including in combination, an amplifier, a loudspeaker, a circuit adapted to be connected to other stations, means including a communication control switch operable in one position to connect said loudspeaker to the circuit and in a second position to connect said loudspeaker to the output and said circuit to the input of said amplifier, an energizing circuit for said amplifier partly completed by said control switch when in said second position, a switch for completing said energizing circuit, and means connected to said circuit and controllable through said circuit for controlling said switch.

14. A unit for use in an intercommunicating system, including in combination, an amplifier, a loudspeaker, a circuit adapted to be connected to other stations, means including a communication control switch operable in one position to connect said loudspeaker to the circuit and in a second position to connect said loudspeaker to the output and said circuit to the input of said amplifier, an energizing circuit for said amplifier partly completed by said control switch when in said second position, a switch for completing said energizing circuit, a solenoid for controlling said switch, said solenoid being connected to a source of power, and means including a normally closed switch for grounding said solenoid when said control switch is in said one position.

15. A unit for use in an intercommunicating system, including in combination, an amplifier, a loudspeaker, a circuit adapted to be connected to other stations, means including a communication control switch operable in one position to connect said loudspeaker to said circuit, in a second position to connect said loudspeaker to the output and said circuit to the input of said amplifier, and in a third position to reverse the connections of said loudspeaker and circuit to said amplifier, an energizing circuit for said amplifier opened by said control switch when in said one position, partly completed by said control switch when in said second position, and completed when in said third position, a normally open switch for completing said energizing circuit when said control switch is in said second position, and means connected to said circuit

and controllable through said circuit for controlling said switch.

16. A unit as claimed in claim 15, wherein said normally open switch is controlled by a solenoid connected to a source of power and to the junction of a pair of resistors connected across said first mentioned circuit, and said junction point is grounded through a normally closed switch in said one position of the communication control switch.

17. In a multiple station intercommunicating system, the combination including, a number of stations adapted to be connected through an in-

terstation circuit and each having an amplifier, a loudspeaker utilizable both as a receiver and a microphone, and a communication control switch normally connecting the loudspeaker to the circuit and operable to connect the loudspeaker to the output and the circuit to the input of said amplifier, and control means at each station for preventing energization of the amplifier at a calling station when the communication control switches thereat are in their said normal positions.

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