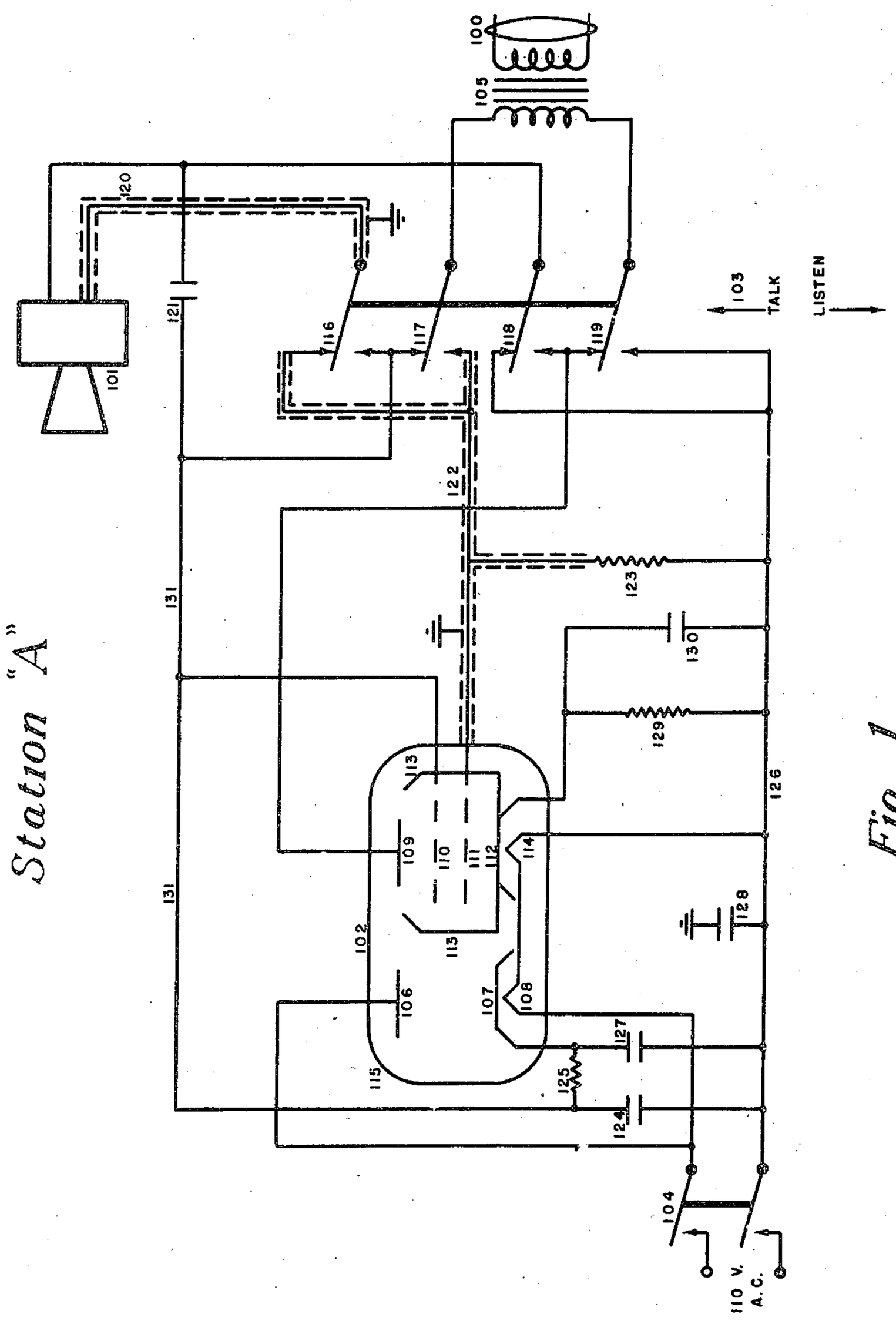
Sept. 16, 1947. W. FELDSCHER 2,427,496

INTERCOMMUNICATION SYSTEM

Filed Oct. 29, 1945 4 Sheets-Sheet 1



Station "A"

Fig. 1

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INTERCOMMUNICATION SYSTEM

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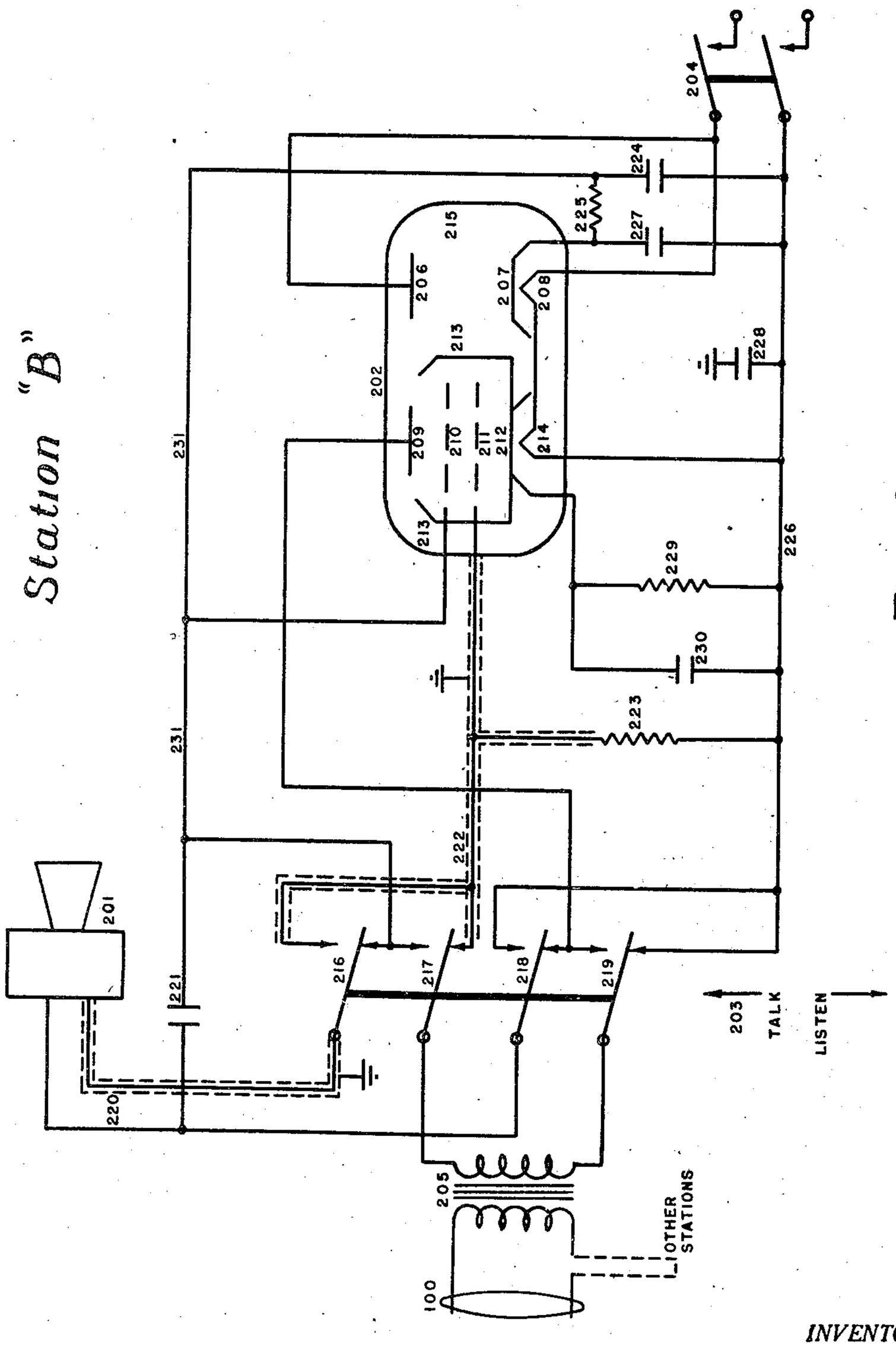

Fig. 2

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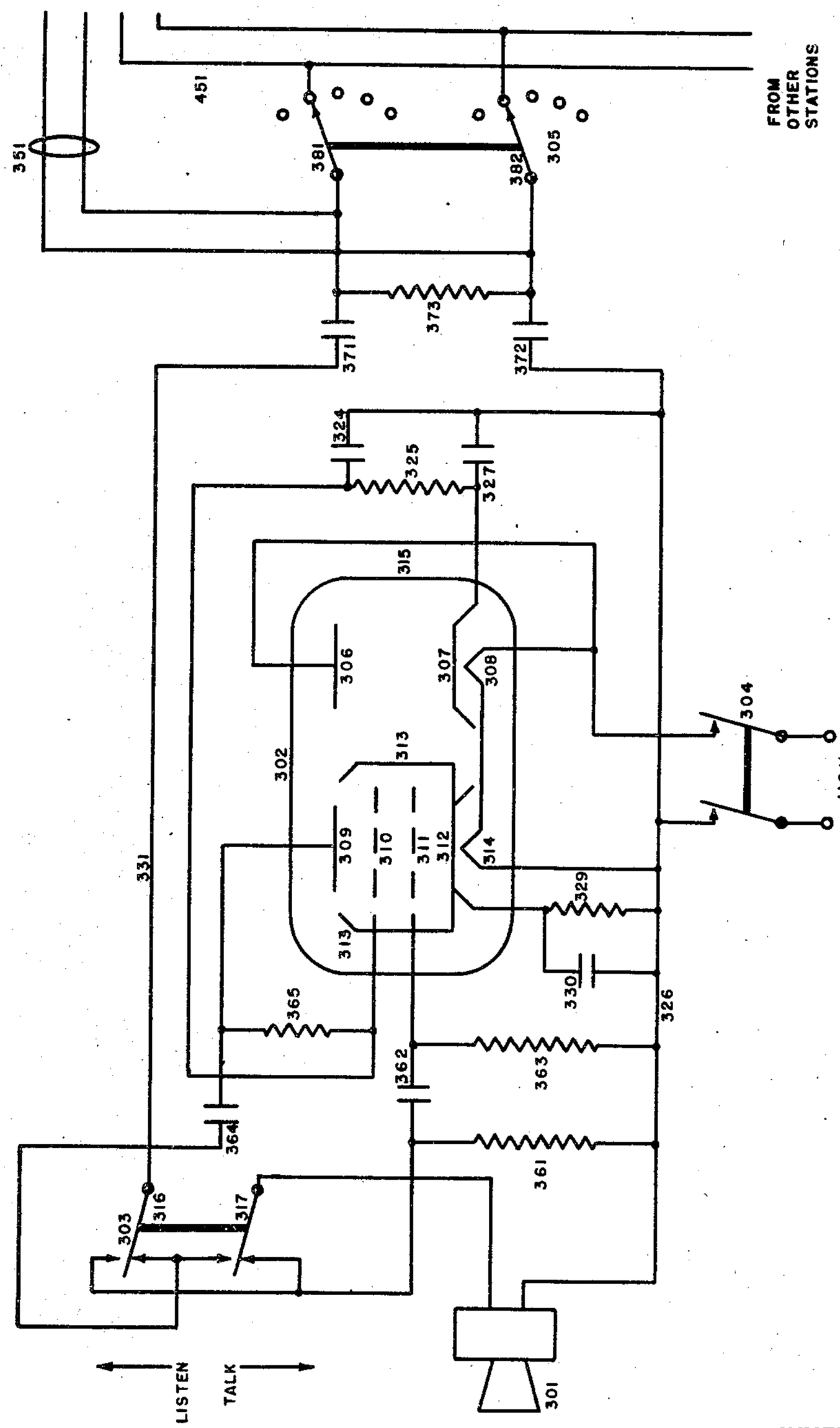

Station 1

Fig. 3

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INTERCOMMUNICATION SYSTEM

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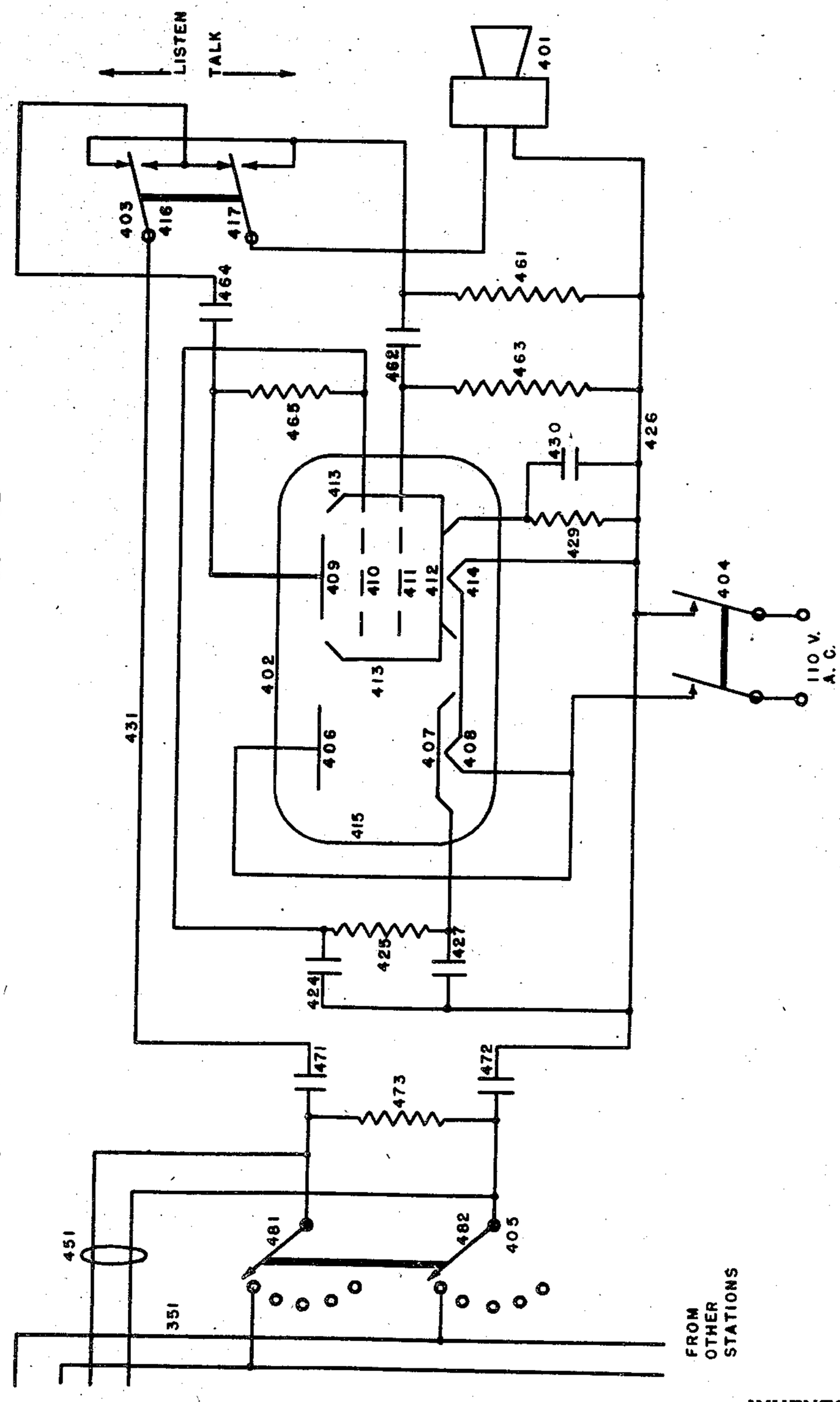

Fig. 4

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UNITED STATES PATENT OFFICE

2,427,496

INTERCOMMUNICATION SYSTEM

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Application October 29, 1945, Serial No. 625,152

12 Claims. (Cl. 179—1)

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This invention relates to intercommunicating apparatus in general, and more particularly to intercommunicating systems comprising a plurality of stations; each station including a transducer usable both as a transmitting microphone and as a loud-speaking receiver.

An object of this invention is to provide an improved intercommunicating system comprising a plurality of stations; each station including a transducer operable either as a transmitting microphone or as a loud-speaking receiver and an amplifier.

Another object of this invention is to provide an improved intercommunicating system comprising a plurality of stations; each station including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver, and an amplifier adapted to function as a voltage amplifier when the associated transducer functions as a microphone and to function as a power amplifier when the associated transducer functions as a loud-speaking receiver.

A further object of this invention is to provide an intercommunicating system comprising a plurality of stations; each station including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver and an amplifier; the amplifier at each station comprising only a part of the total amplification available to that station.

Still another object of this invention is to provide an intercommunicating system comprising a plurality of stations, each of the stations having an amplifying device, and connections between the amplifying devices, whereby the amplifying devices are enabled to function as parts of an amplifying unit during communication between the stations.

Other and further objects will be apparent to those skilled in the art to which this invention relates from the following specification and drawings.

Referring to the drawings briefly, Figs. 1 and 2, taken together, illustrate an intercommunicating system embodying the present invention; Fig. 1 illustrating diagrammatically the apparatus disposed at a station A incorporated in the system, and Fig. 2 illustrating diagrammatically the apparatus disposed at a station B incorporated in the system.

Figs. 3 and 4, taken together, illustrate a modified form of the intercommunicating system embodying the present invention; Fig. 3 illustrating diagrammatically the apparatus disposed at a station #1 incorporated in the system, and Fig. 4 illustrating diagrammatically the apparatus disposed at a station #2 incorporated in the system.

Referring now more particularly to Figs. 1 and 2 of the drawings, the intercommunicating system there illustrated comprises a plurality of stations including the stations A and B, provided with apparatus respectively illustrated in Figs. 1 and 2. More particularly, the apparatus disposed at the station A comprises a transducer **101** operative selectively as a transmitting microphone and as a loud-speaking receiver; a combination rectifier and amplifier tube **102**; a talk-listen key **103**; a master switch **104** for connecting the tube **102** to a source of 110-volt A. C. power supply; and an electric network including a coupling transformer **105** coupling the apparatus at the station A to an associated signalling line **100** extending between each of the stations A, B, etc.

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Preferably, the transducer **101** is of any suitable type such, for example, as the electrodynamic or the piezoelectric type; while the tube **102** is of the 117L7GT type incorporating a rectifier portion (including an anode **106**, a cathode **107** and a cathode heater **108**) and a beam power tetrode portion (including an anode **109**, a screen grid **110**, a control grid **111**, a cathode **112**, beam electrodes **113** and a cathode heater **114**). In the tube **102**, the tetrode portion constitutes a voltage amplifier when the transducer **101** is functioning as a microphone, and constitutes a beam power amplifier when the transducer **101** functions as a loud-speaking receiver. Also in the tube **102** the rectifier and amplifier portions are enclosed in a common envelope **115**; while the cathode heaters **108** and **114** are connected in series to the master switch **104**.

The talk-listen key **103** is of the conventional four-blade double-throw type, selectively operative between talk and listen positions. Specifically, the talk-listen key **103** comprises four blades **116**, **117**, **118** and **119** that are operative together and normally biased to the listen position.

Considering the connection and arrangement of the circuit network in greater detail, one terminal of the transducer **101** is connected through a shielded cable **120** to the blade **116** of the talk-listen key **103**, and the other terminal of this transducer is connected to the blade **118** of the talk-listen key **103** and to the by-pass capacitor **121**. The make contact associated with the blade **116** and the break contact associated with the blade **117** are connected to the control grid **111** of the tetrode amplifier through the shielded cable **122**, which is also connected to the grid leak resistor **123**. The sheaths of both of the shielded cables **120** and **122** are grounded to the chassis of the apparatus to reduce stray pickup in the grid circuit of the tetrode amplifier. The break contact of the blade **116** and the make contact of the blade **117** are connected to the screen grid **110** of the tetrode and to the filter capacitor **124** and resistor **125** through the conductor **131**. The make contact of the blade **118** and the break

contact of the blade 119 are connected to the bus 126; which is connected to one blade of the master power switch 104, to both of the filter capacitors 124 and 127, and to a terminal of the by-pass condenser 128, the other terminal of this latter condenser being grounded to the chassis. The cathode resistor 129 and the cathode resistor shunting capacitor 130 are also connected to the bus 126, together with the lower terminal of the grid leak resistor 123.

The break contact of the blade 118 and the make contact of the blade 119 are connected to the anode 109 of the tetrode amplifier; and the blades 117 and 119 are connected to the primary winding of the coupling transformer 105, the secondary winding of which is connected to the signalling line 100. The coupling transformer 105 comprises a portion of an impedance network for matching the apparatus disposed at the station A to the signalling line 100. More particularly, both the transducer 101 and the coupling transformer 105 are adapted to be matched both to the input and to the output of the tetrode amplifier, as explained more fully hereinafter. Specifically, in the circuit control network disposed at the station A it has been found that the following values for the different elements are quite satisfactory:

Filter capacitor 124	mfd..	40
Filter capacitor 127	mfd..	20
Filter resistor 125	ohms..	500
By-pass capacitor 128	mfd..	0.1
Cathode resistor 129	ohms..	500
Cathode resistor shunting capacitor 130	mfd..	25
Grid leak resistor 123	ohms..	250,000
By-pass capacitor 121	mfd..	0.005

Similarly, the apparatus disposed at the station B comprises a transducer 201 operative selectively as a transmitting microphone and as a loud-speaking receiver; a combination rectifier and amplifier tube 202; a talk-listen key 203; a master switch 204 for connecting the tube 202 to a source of 110-volt A. C. power supply; and an electric network including a coupling transformer 205 coupling the apparatus at the station B to an associated signalling line 100 extending between each of the stations A, B, etc.

Preferably, the transducer 201 is of any suitable type such, for example, as the electrodynamic or the piezo-electric type; while the tube 202 is of the 117L7GT type incorporating a rectifier portion (including an anode 206, a cathode 207 and a cathode heater 208) and a beam power tetrode portion (including an anode 209, a screen grid 210, a control grid 211, a cathode 212, beam electrodes 213 and a cathode heater 214). In the tube 202, the tetrode portion constitutes a voltage amplifier when the transducer 201 is functioning as a microphone, and constitutes a beam power amplifier when the transducer 201 functions as a loud-speaking receiver. Also in the tube 202 the rectifier and amplifier portions are enclosed in a common envelope 215; while the cathode heaters 208 and 214 are connected in series to the master switch 204.

The talk-listen key 203 is of the conventional four-blade double-throw type, selectively operative between talk and listen positions. Specifically, the talk-listen key 203 comprises four blades 216, 217, 218 and 219 that are operative together and normally biased to the listen position.

Considering the connection and arrangement

of the circuit network in greater detail, one terminal of the transducer 201 is connected through a shielded cable 220 to the blade 216 of the talk-listen key 203, and the other terminal of this transducer is connected to the blade 218 of the talk-listen key 203 and to the by-pass capacitor 221. The make contact associated with the blade 216 and the break contact associated with the blade 217 are connected to the control grid 211 of the tetrode amplifier through the shielded cable 222, which is also connected to the grid leak resistor 223. The sheaths of both of the shielded cables 220 and 222 are grounded to the chassis of the apparatus to reduce stray pickup in the grid circuit of the tetrode amplifier. The break contact of the blade 216 and the make contact of the blade 217 are connected to the screen grid 210 of the tetrode and to the filter capacitor 224 and resistor 225 through the conductor 231. The make contact of the blade 218 and the break contact of the blade 219 are connected to the bus 226; which is connected to one blade of the master power switch 204, to both of the filter capacitors 224 and 227, and to a terminal of the by-pass condenser 228, the other terminal of this latter condenser being grounded to the chassis. The cathode resistor 229 and the cathode resistor shunting capacitor 230 are also connected to the bus 226, together with the lower terminal of the grid leak resistor 223.

The break contact of the blade 218 and the make contact of the blade 219 are connected to the anode 209 of the tetrode amplifier; and the blades 217 and 219 are connected to the primary winding of the coupling transformer 205, the secondary winding of which is connected to the signalling line 100. The coupling transformer 205 comprises a portion of an impedance network for matching the apparatus disposed at the station B to the signalling line 100. More particularly, both the transducer 201 and the coupling transformer 205 are adapted to be matched both to the input and to the output of the tetrode amplifier, as explained more fully hereinafter. Specifically, in the circuit control network disposed at the station B it has been found that the following values for the different elements are quite satisfactory:

Filter capacitor 224	mfd..	40
Filter capacitor 227	mfd..	20
Filter resistor 225	ohms..	500
By-pass capacitor 228	mfd..	0.1
Cathode resistor 229	ohms..	500
Cathode resistor shunting capacitor 230	mfd..	25
Grid leak resistor 223	ohms..	250,000
By-pass capacitor 221	mfd..	0.005

Considering now the operation of the intercommunicating system, when the person at the station A wishes to communicate with the person at any other station connected to the system, for example the person at the station B, he merely operates the talk-listen key 103 from its normal listening position to its operated talk position, as illustrated in Fig. 1. This operation of the talk-listen key 103 at the station A causes the transducer 101 to be operative as a transmitting microphone instead of as a loud-speaking receiver, and causes operation of the tetrode amplifier as a first-stage voltage amplifier instead of as a second-stage power amplifier. It is further assumed that at this time the master switch 104 at the station A occupies its closed position and that the master switch at the other sta-

tion, such for example as the master switch 204 at the station B, occupies its closed position.

When the master switch 104 at the station A is closed, the source of 110-volt alternating current power supply is connected directly across the series-connected cathode heaters 108 and 114, whereby the heaters mentioned effect heating of the associated cathodes 107 and 112 in order to render these cathodes electron emissive. Also, closing the master switch 104 applies the 110-volt alternating current to the anode 106 of the rectifier. When the positive half-cycle of the alternating current is applied to this anode 106 current flows between the cathode 107 and the anode 106, thereby charging the capacitor 127; and at the same time some of this current flows through the resistor 125, also partially charging the capacitor 124. The current also at this time flows through the conductor 131, applying a positive potential to the screen grid 110 of the tetrode; and thence through the blade 117 of the talk-listen key 103 to the primary of the transformer 105; and from the primary of this transformer 105 through the blade 119 of the talk-listen key 103 to the anode 109 of the tetrode amplifier, thereby rendering the amplifier operative. When the negative half-cycle of the alternating current is applied to the anode 106 of the rectifier, no current flows between the cathode 107 and the anode 106; and during this half-cycle current for the tetrode amplifier is supplied by the capacitors 124 and 127 of the filter network, inasmuch as during this half-cycle these capacitors at least partially discharge, thereby applying a positive potential to the conductor 131 and to the screen grid 110 of the tetrode amplifier. Current from the conductor 131 is supplied to the primary of the transformer 105 and to the anode 109 of the tetrode amplifier through the aforesaid blades 117 and 119 of the talk-listen key 103.

Inasmuch as the transducer 101 connected to the grid 111 of the tetrode amplifier functions at this time as a microphone, modulated potentials produced by this transducer modulate the electron stream through the tetrode amplifier, and the aforesaid currents flowing from the conductor 131 through the blade 117 of the talk-listen key 103, the primary of the transformer 105, and the blade 119 of the talk-listen key 103 to the anode of this tetrode amplifier are modulated by the action of the grid 111 of the tetrode amplifier in accordance with the sound vibrations picked up by the transducer 101. These undulating electric currents produced by the operation of the voltage amplifier are applied to the signalling line 100 by the transformer 105, and they are received from this line by the transformer 205 at the station B and the corresponding transformers at the other stations.

Considering now the operation of the apparatus at one of the stations operating as a receiving station, such for example as the station B, the amplified undulating currents transmitted over the signalling line 100 effect operation of the coupling transformer 205, the primary winding of which is connected to the blades 217 and 219 of the talk-listen key 203. More particularly, at this time it is assumed that the talk-listen key 203 occupies its normal listen position and that the power switch 204 occupies its closed position, whereby the undulating currents are fed over the shielded conductor 222 connected to the break contact of the blade 217 to the control grid 211 of the tetrode amplifier. Undulating currents are also fed from the break contact of the blade

219 to the cathode of the tetrode amplifier by way of the conductor 226 and the cathode resistor 229 and cathode resistor shunting condenser 230. These undulating currents are amplified by the tetrode amplifier through the operation of the control grid 211 and its influence on the electron stream between the cathode 212 and the anode 209, so that corresponding undulating currents of an amplified order are fed from the anode 209 of the tetrode amplifier through the break contact of the blade 218 to one terminal of the transducer 201 which is connected to the blade 218. The other terminal of the transducer 201 is connected to the blade 216 and through the break contact of this blade 216 to the conductor 231, which is connected to the screen grid electrode 210 of the tetrode amplifier and to the filter network consisting of the capacitors 224 and 227 and the resistor 225; whereby the transducer 201, functioning as a loud-speaking receiver, reproduces sounds corresponding to the undulating currents fed thereto.

The rectifier, consisting of the anode 206, the cathode 207 and the cathode heater 208, functions in the same manner as the corresponding rectifier disposed at the station A and illustrated in Fig. 1, in that during the interval when the positive half-cycle is applied to the anode 206, current flows between the cathode 207 and the anode 206, thereby charging the capacitor 227; and at the same time, some of this current flows through the resistor 225, also partially charging the capacitor 224. The current also at this time flows through the conductor 231 as described above. Thus, the transducer 201 functions as a loud-speaking receiver and the tetrode amplifier functions as a beam power amplifier.

Of course it will be understood that in the intercommunicating system after the person at the station A is through talking he may restore the associated talk-listen key 103 to its normal listen position, whereby the station A is converted to a receiving station; and at this time the person at the station B may operate the associated talk-listen key 203 to its talk position, whereby the station B is converted to a transmitting station. Further, it will be understood that when any one of the stations is operating as a transmitting station, the associated transducer functions as a transmitting microphone and the associated tetrode amplifier functions as a voltage amplifier; whereas when any one of the stations is operating as a receiving station, the associated transducer functions as a loud-speaking receiver and the associated tetrode amplifier functions as a beam power amplifier. Finally, it will be appreciated that only one station at any one time may operate as a transmitting station, whereas all of the other stations may operate simultaneously as receiving stations.

Referring now more particularly to Figs. 3 and 4 of the drawings, the modified form of the intercommunicating system there illustrated comprises a plurality of stations, including the station #1 and the station #2, provided with apparatus respectively illustrated in Figs. 3 and 4. More particularly, the apparatus disposed at the station #1 comprises a transducer 301 operative selectively as a transmitting microphone and as a loud-speaking receiver; a combination rectifier and amplifier tube 302; a talk-listen key 303; a master switch 304 for connecting the tube 302 to a source of 110 volt A. C. power supply; an impedance matching network including a station selector switch 305; and a

home signalling line 351, accessible to the selector switches at each of the other stations.

Preferably, the transducer 301 is of any suitable type, such for example as the electrodynamic or the piezoelectric type; while the tube 302 is of the 117P7GT type incorporating a rectifier portion (including an anode 306, a cathode 307, and a cathode heater 308) and a beam power tetrode portion (including an anode 309, a screen grid 310, a control grid 311, a cathode 312, beam electrodes 313 and a cathode heater 314). In the tube 302, the tetrode portion constitutes a voltage amplifier when the transducer 301 is functioning as a microphone, and constitutes a beam power amplifier when the transducer 301 is functioning as a loud-speaking receiver. Also, in the tube 302 the rectifier and amplifier portions are enclosed in a common envelope 315; while the cathode heaters 308 and 314 are connected in series to the master switch 304.

The talk-listen key 303 is of the conventional two-blade double-throw type, selectively operative between talk and listen positions. Specifically, the talk-listen key 303 comprises two blades 316 and 317 that are operative together and normally biased to the listen position.

Considering the connection and arrangement of the circuit network in greater detail, one terminal if the transducer 301 is connected to the blade 317 of the talk-listen key 303 and the other terminal of this transducer is connected through the bus 326 and the cathode resistor 329 and cathode resistor shunting capacitor 330, to the cathode 312 of the tetrode amplifier.

The make contact associated with the blade 316 and the break contact associated with the blade 317 are connected through the impedance network (consisting of the resistor 361, coupling capacitor 362, and grid leak resistor 363) to the control grid 311 of the tetrode amplifier. The break contact of the blade 316 and the make contact of the blade 317 are connected together and through a coupling capacitor 364 to the anode 309 of the tetrode amplifier. The anode 309 of the tetrode amplifier is connected to the screen grid 310 of the tetrode amplifier through the resistor 365, which in turn is connected to the filter network consisting of the filter capacitors 324 and 327 and the filter resistor 325. The filter resistor 325 and the filter capacitor 327 are connected to the cathode 307 of the rectifier. The blade 316 of the talk-listen key 303 is connected through the conductor 331 to the capacitor 371 of the impedance matching network consisting of capacitors 371 and 372 and resistor 373. The capacitor 372 is connected to the bus 326, which is also connected to one side of the master power switch 304. The other side of the master power switch 304 is connected to one terminal of the series-connected cathode heaters 308 and 314 and to the rectifier anode 306, the other terminal of the series-connected cathode heaters 308 and 314 being connected to the bus 326.

Thus the busses 331 and 326 are respectively connected by way of the coupling capacitors 371 and 372 to the terminals of the resistor 373, which in turn are connected to the line conductors of the home line 351 and to the respective wipers of the station selector switch 305; the station selector switch 305 is of the conventional rotary type including two rotary wipers 381 and 382 provided with individually associated contact banks. The contacts in the contact banks respectively associated with the rotary wipers 381 and 382 of the station selector switch 305 are paired and terminate the corresponding line conductors of the home lines extending to the other stations #2, etc. The impedance network including the coupling capacitors 371 and 372 and the resistor 373 matches the apparatus disposed at the station #1 to the home line 351 and to any of the home lines extending to the other stations #2, etc., selected by way of the associated station selector switch 305. More particularly, both the transducer 301 and the impedance network mentioned are adapted to be matched both to the input and to the output of the tetrode amplifier, as explained more fully hereinafter.

Similarly, the apparatus disposed at the station #2 comprises a transducer 401 operative selectively as a transmitting microphone and as a loud-speaking receiver; a combination rectifier and amplifier tube 402; a talk-listen key 403; a master switch 404 for connecting the tube 402 to a source of 110 volt A. C. power supply; an impedance matching network including a station selector switch 405; and a home signalling line 451, accessible to the selector switches at each of the other stations.

Preferably, the transducer 401 is of any suitable type, such for example as the electrodynamic or the piezo-electric type; while the tube 402 is of the 117P7GT type incorporating a rectifier portion (including an anode 406, a cathode 407, and a cathode heater 408) and a beam power tetrode portion (including an anode 409, a screen grid 410, a control grid 411, a cathode 412, beam electrodes 413 and a cathode heater 414). In the tube 402, the tetrode portion constitutes a voltage amplifier when the transducer 401 is functioning as a microphone, and constitutes a beam power amplifier when the transducer 401 is functioning as a loud-speaking receiver. Also, in the tube 402 the rectifier and amplifier portions are enclosed in a common envelope 415; while the cathode heaters 408 and 414 are connected in series to the master switch 404.

The talk-listen key 403 is of the conventional two-blade double-throw type, selectively operative between talk and listen positions. Specifically, the talk-listen key 403 comprises two blades 416 and 417 that are operative together and normally biased to the listen position.

Considering the connection and arrangement of the circuit network in greater detail, one terminal of the transducer 401 is connected to the blade 417 of the talk-listen key 403 and the other terminal of this transducer is connected through the bus 426 and the cathode resistor 429 and cathode resistor shunting capacitor 430, to the cathode 412 of the tetrode amplifier.

The make contact associated with the blade 416 and the break contact associated with the blade 417 are connected through the impedance network (consisting of the resistor 461, coupling capacitor 462 and grid leak resistor 463) to the control grid 411 of the tetrode amplifier. The break contact of the blade 416 and the make contact of the blade 417 are connected together and through a coupling capacitor 464 to the anode 409 of the tetrode amplifier. The anode 409 of the tetrode amplifier is connected to the screen grid 410 of the tetrode amplifier through the resistor 465, which in turn is connected to the filter network consisting of the filter capacitors 424 and 427 and the filter resistor 425. The filter resistor 425 and the filter capacitor 427 are connected to the cathode 407 of the rectifier. The blade 416 of the talk-listen key 403

is connected through the conductor 431 to the capacitor 471 of the impedance matching network consisting of capacitors 471 and 472 and resistor 473. The capacitor 472 is connected to the bus 426, which is also connected to one side of the master power switch 404. The other side of the master power switch 404 is connected to one terminal of the series-connected cathode heaters 408 and 414 and to the rectifier anode 406, the other terminal of the series-connected cathode heaters 408 and 414 being connected to the bus 426.

Thus the busses 431 and 426 are respectively connected by way of the coupling capacitors 471 and 472 to the terminals of the resistor 473, which in turn are connected to the line conductors of the home line 451 and to the respective wipers of the station selector switch 405; the station selector switch 405 is of the conventional rotary type including two rotary wipers 481 and 482 provided with individually associated contact banks. The contacts in the contact banks respectively associated with the rotary wipers 481 and 482 of the station selector switch 405 are paired and terminate the corresponding line conductors of the home lines extending to the other stations #1, etc. The impedance network including the coupling capacitors 471 and 472 and the resistor 473 matches the apparatus disposed at the station #2 to the home line 451 and to any of the home lines extending to the other stations #1, etc., selected by way of the associated station selector switch 405. More particularly, both the transducer 401 and the impedance network mentioned are adapted to be matched both to the input and to the output of the tetrode amplifier, as explained more fully hereinafter.

Considering now the operation of the intercommunicating system, when the person at the station #1 wishes to communicate with the person at any other station connected to the system, for example the person at the station #2, he first operates the talk-listen key 303 from its normal listening position to its operated talk position, as illustrated in Fig. 3. This operation of the talk-listen key 303 at the station #1 causes the transducer 301 to be operative as a transmitting microphone instead of as a loud-speaking receiver, and causes operation of the tetrode amplifier as a first-stage voltage amplifier instead of as a second-stage power amplifier. The person at the station #1 then operates the station selector switch 305 to the position corresponding to the desired station, such for example as to the second position, corresponding to the station #2. It is further assumed that at this time the master switch 304 at the station #1 occupies its closed position and that the master switch at each of the other stations, such for example as the master switch 404 at the station #2, occupies its closed position. When the master switch 304 at the station #1 is closed, the source of 110-volt alternating current power supply is connected directly across the series-connected cathode heaters 308 and 314, whereby the heaters mentioned effect heating of the associated cathodes 307 and 312 in order to render these cathodes electron emissive. Also, closing the master switch 304 applies the 110-volt alternating current to the anode 306 of the rectifier. When the positive half-cycle of the alternating current is applied to this anode 306, current flows between the cathode 307 and the anode 306, thereby charging the capacitor 327; and at the same time some of this current flows through the resistor 325, also partially charging the capacitor 324. Also, the rectified current applies a positive potential to the screen grid 310 of the tetrode amplifier, and current flows thence through the resistor 365 to the anode 309 of the tetrode amplifier, thereby rendering the amplifier operative. When the negative half-cycle of the alternating current is applied to the anode 306 of the rectifier, no current flows between the cathode 307 and the anode 306; and during this half-cycle current for the tetrode amplifier is supplied by the capacitors 324 and 327 of the filter network, inasmuch as during this half-cycle these capacitors at least partially discharge, thereby applying a positive potential to the screen grid 310 and current through the resistor 365 to the anode 309 of the tetrode amplifier.

Inasmuch as the transducer 301 connected to the blade 317 of the talk-listen key 303 is coupled by way of the capacitor 362 to the control grid 311 of the tetrode amplifier, modulated potentials produced by this transducer modulate the electron stream through the tetrode amplifier. The modulated currents in the output of the tetrode amplifier are impressed by way of the coupling capacitor 364, the blade 316 of the talk-listen key 303, and the associated break contact, upon the conductor 331. Thus the output of the tetrode amplifier is applied between the bus 326 and the conductor 331, which are connected to the capacitors 371 and 372 across the wipers 381 and 382 of the station selector switch 305 and consequently across the line conductors of the selected home line 451 extending to the station #2. Accordingly, the transducer 301 is operative as a transmitting microphone to control the tetrode amplifier, whereby voltage amplified undulating signal currents are transmitted over the station selector switch 305 and the selected home line 451 extending to the apparatus at the station #2.

Considering now the operation of the apparatus at one of the stations operating as a receiving station, such for example as the station #2, the amplified undulating currents transmitted over the associated home line 451 are impressed across the resistor 473 and consequently by way of the coupling capacitors 471 and 472 across the bus 426 and the conductor 431. More particularly, the conductor 431 is connected by way of the blade 416 and the associated break contact of the talk-listen key 403, occupying its normal listen position, and the coupling capacitor 462 to the control grid 411 of the tetrode amplifier, whereby the electron stream between the anode 409 and the cathode 412 of the tetrode amplifier is modulated in accordance with the received undulating currents. The output of the tetrode amplifier is applied from the anode 409 of the tetrode amplifier through the coupling capacitor 464 and the break contact of the blade 417 of the talk-listen key 403 to one terminal of the transducer 401, now functioning as a loud-speaking receiver, the other terminal of the transducer 401 being connected to the bus 426. Thus, the transducer 401 functions as a loud-speaking receiver to reproduce at the station #2 the signals received over the associated home line 451 from the station #1. Also, at this time at the station #2 the master switch 404 occupies its closed position, thereby rendering the rectifier operative in a manner identical to that previously explained in conjunction with the rectifier disposed at the station #1. Thus at this time the transducer 401 functions as a loud-speaking re-

ceiver, and the tetrode amplifier functions as a beam power amplifier.

Of course it will be understood that in the intercommunicating system, after the person at the station #1 is through talking he may restore the associated talk-listen key **303** to its normal listen position, whereby the station #1 is converted to a receiving station; and at this time the person at the station #2 may operate the associated talk-listen key **403** to its talk position, whereby the station #2 is converted to a transmitting station. Further it will be understood that when any one of the stations is operating as a transmitting station, the associated transducer functions as a transmitting microphone and the associated tetrode amplifier functions as a voltage amplifier; whereas when ony one of the stations is operating as a receiving station, the associated transducer functions as a loud-speaking receiver and the associated tetrode amplifier functions as a beam power amplifier.

Finally, it will be appreciated that only one station at any one time may operate as a transmitting station, whereas normally only one station operates therewith as a receiving station. However, a conference connection can be set up between the transmitting station and any number of receiving stations. This is accomplished by the person at the transmitting station making successive calls to the persons at the receiving stations and causing the persons at the different receiving stations to operate their associated station selector switches in order to select the home line extending to the transmitting station. When a conference connection is thus set up, the station selector switch at the transmitting station may be released in view of the fact that the home line extending to the transmitting station has been selected by the station selector switches at the connected receiving stations.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that many modifications may be made therein and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. An intercommunicating system comprising first and second stations and a signalling channel extending therebetween; each of said stations including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver, an amplifier provided with input and output terminals, a switching device selectively operative between talking and listening positions, and a circuit network so connected and arranged that said first station switching device is operative when in its talking position to connect said first station transducer to the input terminals of said first station amplifier and to connect the output terminals of said first station amplifier to said signalling channel, and that said second station switching device is operative when in its listening position to connect said second station transducer to the output terminals of said second station amplifier and to connect the input terminals of said second station amplifier to said signalling channel at the same time as said first station amplifier is connected to said signalling channel.

2. An intercommunicating system comprising first and second stations and a signalling channel extending therebetween; each of said stations including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver, a vacuum tube provided with input and output terminals, a switching device selectively operative between talking and listening positions, and a circuit network so connected and arranged that said first station switching device is operative when in its talking position to connect said first station transducer to the input terminals of said first station vacuum tube and to connect the output terminals of said first station vacuum tube to said signalling channel, and that said second station switching device is operative when in its listening position to connect said second station transducer to the output terminals of said second station vacuum tube and to connect the input terminals of said second station vacuum tube to said signalling channel at the same time as said first station vacuum tube is connected to said signalling channel.

3. An intercommunicating system comprising first and second stations and a signalling channel extending therebetween; each of said stations including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver, a vacuum tube of the beam-power type provided with input and output terminals, a switching device selectively operative between talking and listening positions, and a circuit network so connected and arranged that said first station switching device is operative when in its talking position to connect said first station transducer to the input terminals of said first station vacuum tube and to connect the output terminals of said first station vacuum tube to said signalling channel, and that said second station switching device is operative when in its listening position to connect said second station transducer to the output terminals of said second station vacuum tube and to connect the input terminals of said second station vacuum tube to said signalling channel at the same time as said first station vacuum tube is connected to said signalling channel.

4. An intercommunicating system comprising first and second stations and a signalling channel extending therebetween; each of said stations including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver, an amplifier of the pentode type, a rectifier connected to rectify alternating current for supplying said pentode with direct current, a high capacity filter circuit for filtering the rectified output of said rectifier; a separate alternating current supply connected to each of said rectifiers; an impedance network for said first station for matching the input and output of said first station amplifier to said first station transducer and signalling channel, respectively; an impedance network for said second station for matching the input and output of said second station amplifier to said signalling channel and to said second station transducer, respectively; and means for simultaneously connecting said amplifiers to said signalling channel.

5. An intercommunicating system comprising first and second stations and a signalling channel extending therebetween; each of said stations including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver, an amplifier of the pentode type, a rectifier connected to rectify alternating current for supplying said pentode with direct current, a high capacity filter circuit for filtering the rectified output of said rectifier, a talk-listen switch for connecting said transducer either to the input or

the output of said pentode amplifier; a separate alternating current supply connected to each of said rectifiers; an impedance network for said first station for matching the input and output of said first station amplifier to said first station transducer and signalling channel, respectively; and an impedance network for said second station for matching the input and output of said second station amplifier to said signalling channel and to said second station transducer, respectively; said amplifiers being connected simultaneously to said signalling channel.

6. An intercommunicating system comprising a plurality of stations and a signalling channel extending therebetween; each of said stations including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver, and an amplifier having at least a pair of stages; one of said stages being at each of said plurality of stations, each of said stages being adapted to function either as an input stage or as an output stage; impedance networks connected to each end of said signalling channel, said impedance networks and said signalling channel being connected between and simultaneously to the stages of said amplifier.

7. An intercommunicating system comprising a plurality of stations and a signalling channel extending therebetween; each of said stations including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver, and an amplifier having at least a pair of stages; one of said stages being at each of said plurality of stations, each of said stages being adapted to function either as an input stage or as an output stage; impedance networks connected to each end of said signalling channel, said impedance networks and said signalling channel being connected between the stages of said amplifier; and means at each station for connecting the stage at that station to function either as an input stage or as an output stage.

8. An intercommunicating system comprising a plurality of stations and a signalling channel extending therebetween; each of said stations including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver, and an amplifier having at least a pair of stages; one of said stages being at each of said plurality of stations, each of said stages being adapted to function either as an input stage or as an output stage; impedance networks connected to each end of said signalling channel, said impedance networks and said signalling channel being connected between the stages of said amplifier; and means including a talk-listen switch at each station for connecting the stage at that station to function either as an input stage or as an output stage.

9. An intercommunicating system comprising first and second stations and a signalling channel extending therebetween; said first station including a microphone, a first-stage amplifier provided with input and output terminals, and means including a circuit network for coupling said microphone to the input terminals of said first-stage amplifier and for coupling the output terminals of said first-stage amplifier to said signalling channel; said second station including a loud-speaking receiver, a second-stage amplifier provided with input and output terminals, and means including a circuit network for coupling said loud-speaking receiver to the output terminals of said second-stage amplifier and for coupling the input terminals of said second-stage amplifier to said signalling channel.

10. An intercommunicating system comprising first and second stations and a signalling channel extending therebetween; said first station including a microphone, a voltage amplifier provided with input and output terminals, and means including a circuit network for coupling said microphone to the input terminals of said voltage amplifier and for coupling the output terminals of said voltage amplifier to said signalling channel; said second station including a loud-speaking receiver, a power amplifier provided with input and output terminals, and means including a circuit network for coupling said loud-speaking receiver to the output terminals of said power amplifier and for coupling the input terminals of said power amplifier to said signalling channel.

11. An intercommunicating system comprising a first station including a microphone, a second station including a loud-speaking receiver, and a link interconnecting said microphone and said loud-speaking receiver; said link including a first-stage amplifier provided with input terminals coupled to said microphone and output terminals, a second-stage amplifier provided with output terminals coupled to said loud-speaking receiver and input terminals, and a signal line extending between said first and second stations, one end of said signal line being coupled to the output terminals of said first-stage amplifier and the other end of said signal line being coupled simultaneously to the input terminals of said second-stage amplifier.

12. An intercommunicating system comprising a plurality of stations and a plurality of signalling lines respectively extending to said stations; each of said stations including a transducer operative selectively as a transmitting microphone and as a loud-speaking receiver, an amplifier provided with input and output terminals, a selector switch having access to the signal lines extending to each of the other of said stations, a switching device selectively operative between talking and listening positions, and a circuit network so connected and arranged that said switching device is operative to its talking position to couple said transducer to the input terminals of said amplifier and to couple the output terminals of said amplifier to said selector switch and to the associated signalling line and that said switching device is operative to its listening position to couple said transducer to the output terminals of said amplifier and to couple the input terminals of said amplifier to said selector switch and to the associated signalling line.

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