

June 27, 1933.

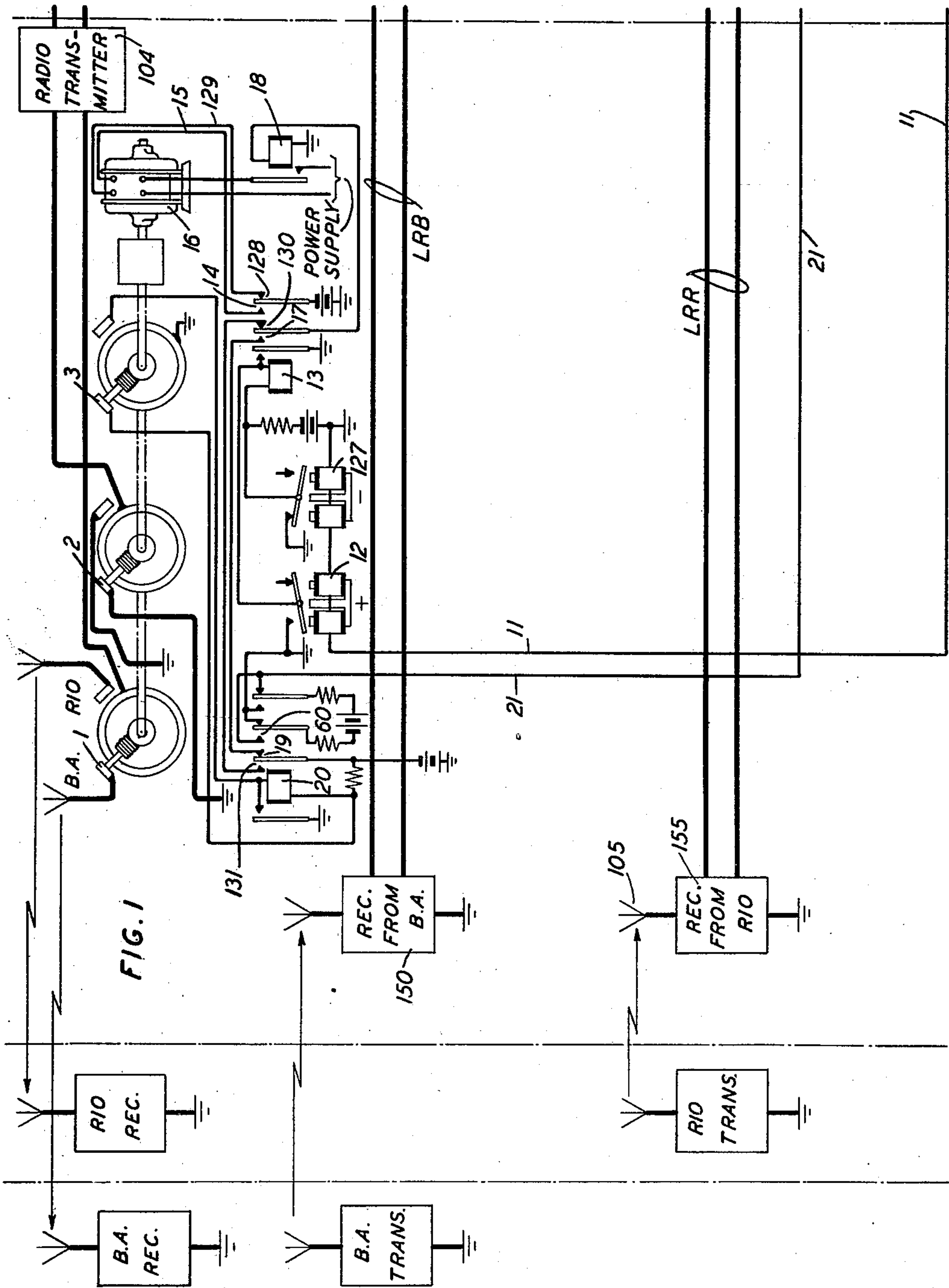
H. M. PRUDEN ET AL

1,915,382

RADIO TELEPHONE SYSTEM

Filed Aug. 15, 1931

4 Sheets-Sheet 1



INVENTORS: H.M. PRUDEN
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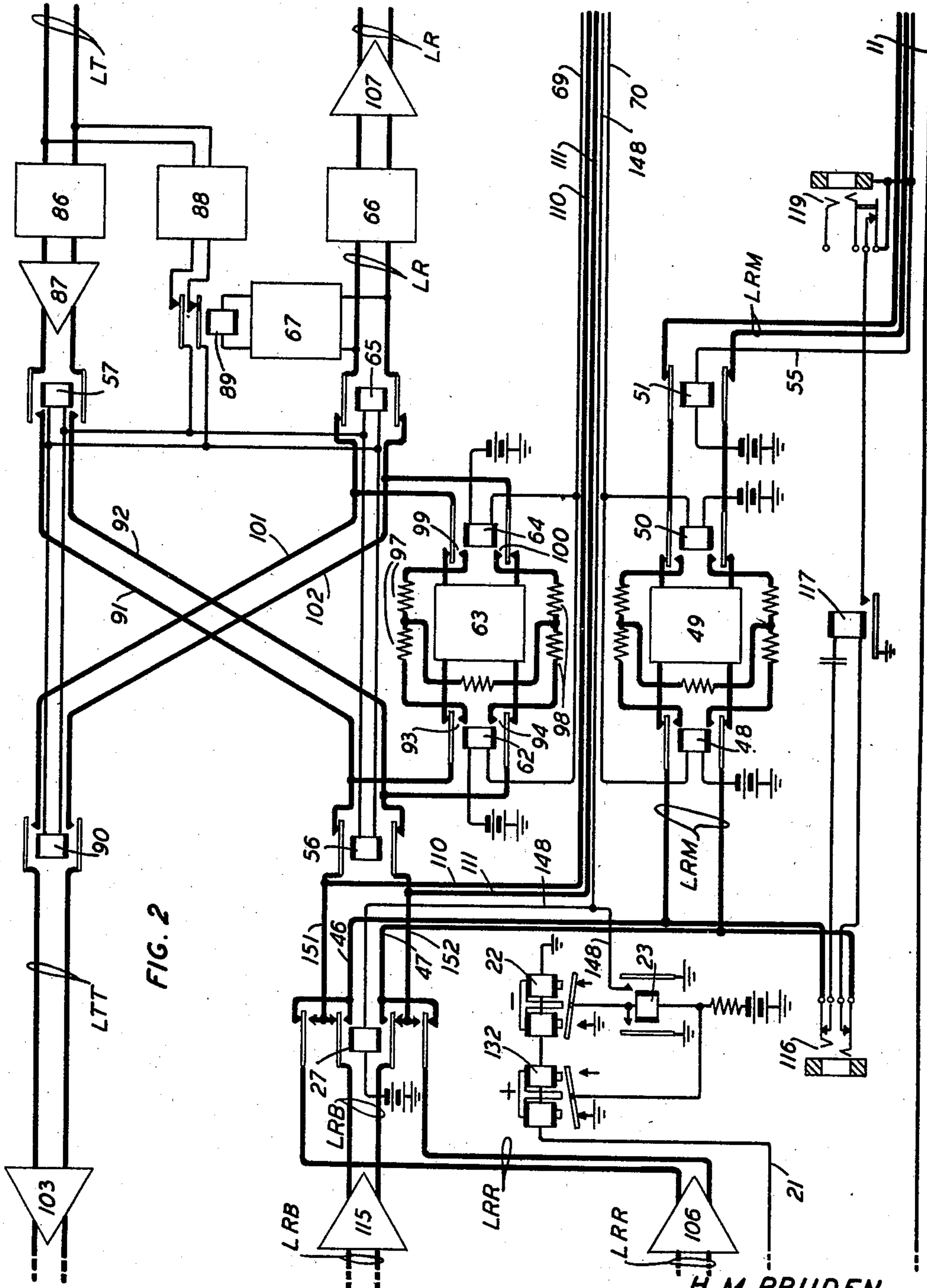
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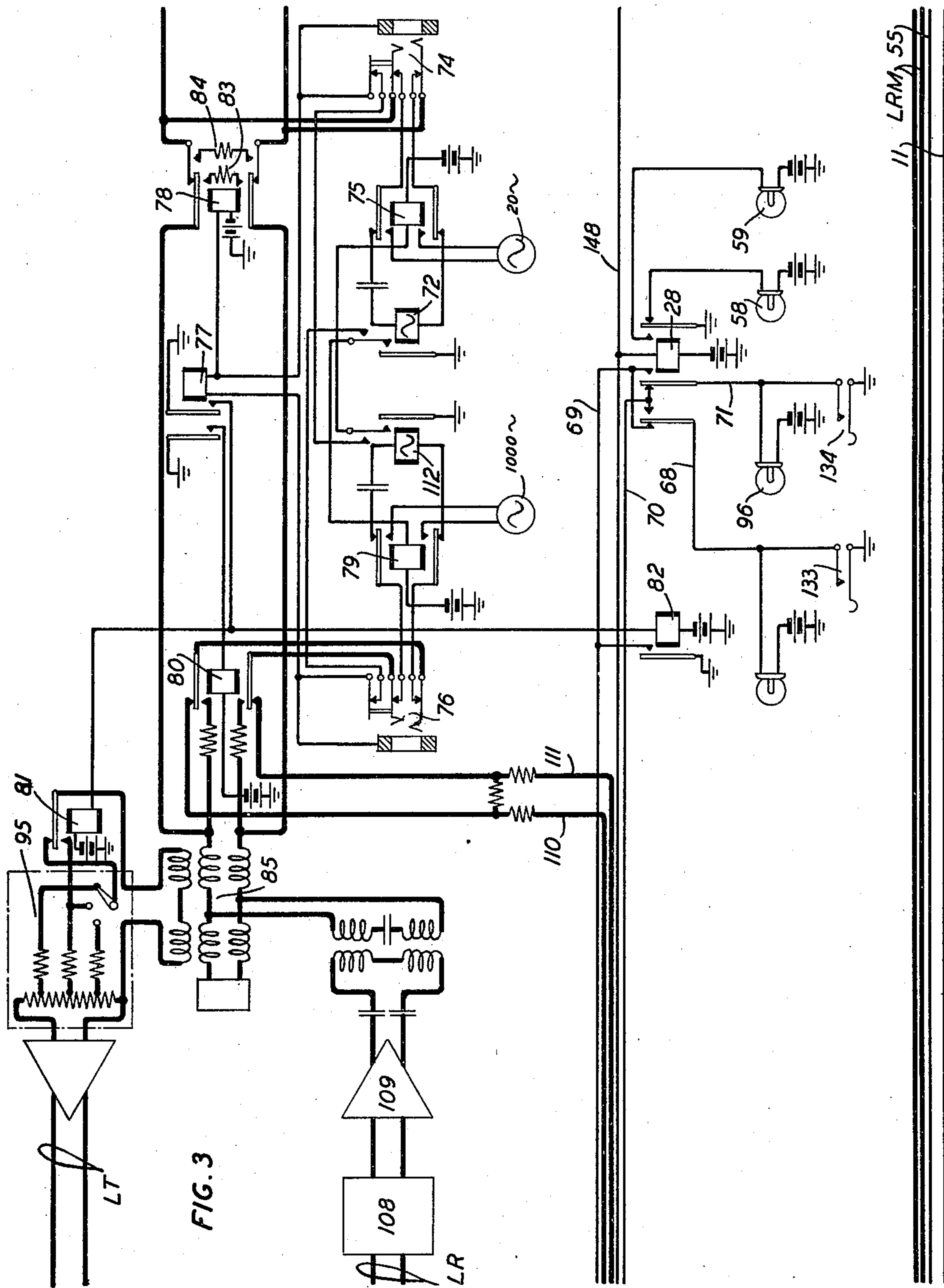
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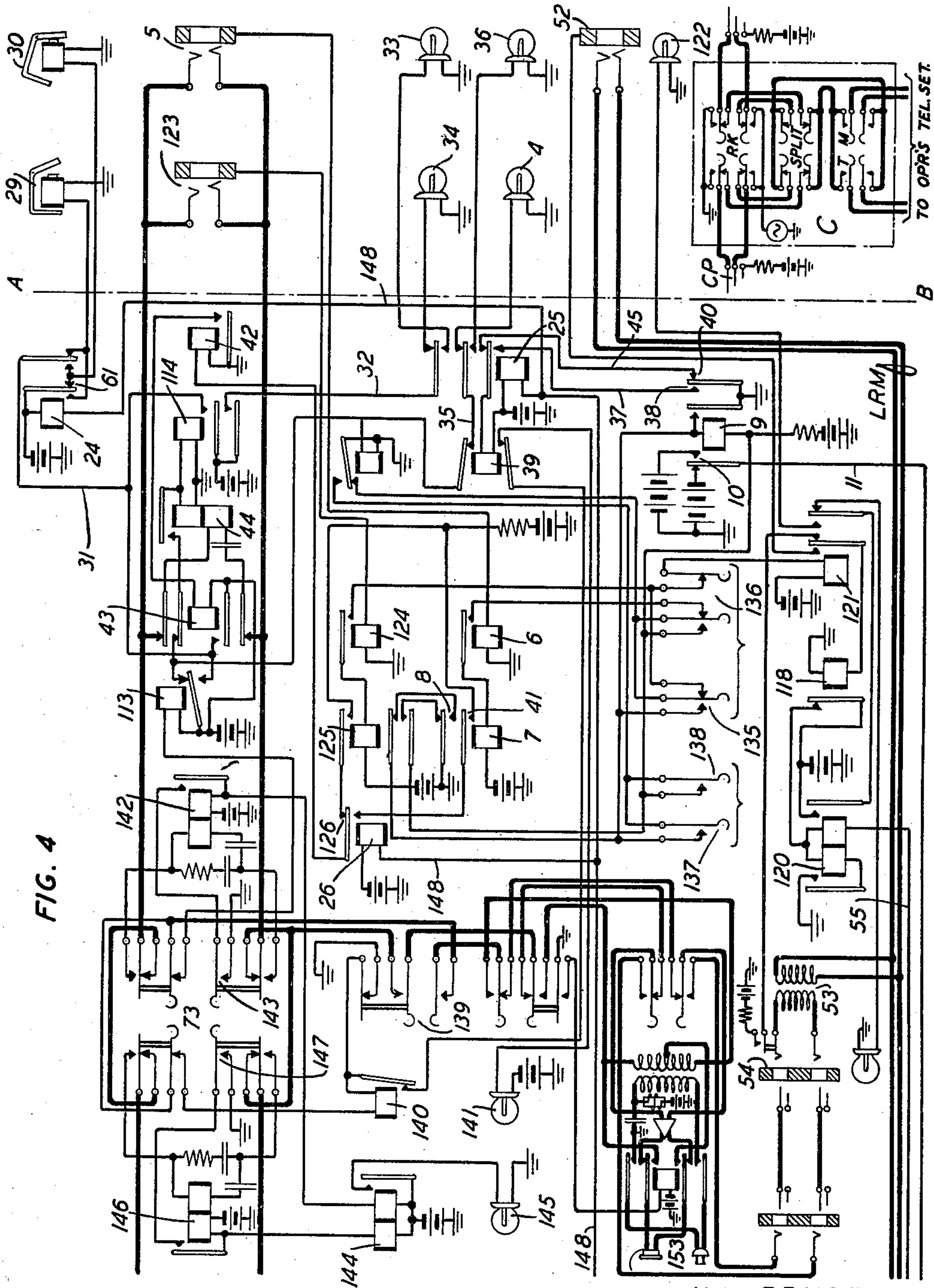
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RADIO TELEPHONE SYSTEM

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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RADIO TELEPHONE SYSTEM

Application filed August 15, 1931. Serial No. 557,232.

This invention relates to circuit arrangements for connecting a wire telephone system to a radio system and more particularly to an arrangement whereby communication facilities may be provided between a telephone exchange system and two geographically separated points by means of a radio link.

An object of the invention is to selectively transmit, by means of a single radio transmitter, to either of two distant radio stations, under automatic control effected by an operator at the telephone exchange.

In accordance with this object, therefore, a feature of the invention resides in switching means at the radio transmitting station for associating the transmitter with one or the other of two differently directed directive antenna systems and in automatically controlling the switching means in a predetermined manner over a circuit extending between the telephone switchboard and the radio station. In practice two jacks are located in the face of the switchboard, one for each of the distant points to be communicated with, and corresponding thereto. The talking contacts of these jacks are connected in multiple to the toll line circuit connecting the exchange with the radio station. The sleeve circuits of these jacks are separate, however, and, depending upon which jack the operator selects by plugging in her cord circuit, the switching means at the radio station is caused to operate to switch the radio transmitter into connection with the antenna having the proper directional characteristics to communicate with the desired distant station.

A further feature of this invention resides in an indicating arrangement whereby the operator at the switchboard is apprised, by means of signaling devices, when the switching operation is completed to the desired antenna, the signal continuing as a positive indication of the connection of the antenna with the transmitter until the switch is again operated.

Still another feature resides in switching means also controlled at the time the antenna switch is operated to automatically associate

the corresponding receiving station with the line to the exchange and to connect the other receiver with an auxiliary monitoring circuit terminating at the switchboard whereby an operator may listen in or monitor on the receiver not connected to the two-way conversation circuit.

The invention will be understood from the following description when read in connection with the accompanying drawings, the figures of which, if placed end to end so that the figure numbers read sequentially from left to right, represent one terminal of a radio telephone system embodying the invention.

Fig. 1 shows the equipment at the radio transmitting and receiving stations; and

Figs. 2, 3 and 4 show the equipment at the telephone exchange terminal of the wire line extending between the radio stations and the telephone exchange which, for purposes of description, will be assumed to be in New York.

The equipment consisting of busy signals, jacks and lamp signals and the operator's cord circuit C, at the right of the vertical broken line A—B in Fig. 4, represents the equipment at the regular toll operator's position in the New York toll office, and all other equipment shown on Figs. 2, 3 and 4 represents the equipment at what is known as the control or technical operator's position which may for convenience be located in the same building as the toll switchboard. The various antennae which are shown by the conventional symbol on the drawings are of two general types, one transmitting and the other receiving. These antennae may be of any suitable type, for example, the transmitting antennae may be of the type disclosed in British Patent 329,321, accepted May 13, 1930 and the receiving antennae of the type disclosed in United States Patent to Bruce, No. 1,813,143, July 7, 1931.

It will also be assumed that one of the directive transmitting antennae is pointed or directed to transmit to Buenos Aires and the other directed to transmit to Rio de Janeiro.

It will be further assumed, for purposes of description, that the last conversation was

with Buenos Aires and, therefore, the antennæ switch (Fig. 1) consisting of switch arms 1, 2 and 3 is in its left-hand position and certain relays are operated, as shown in the drawings. Also, the service lamp 4 at the operator's position will be lighted. It may now be assumed that the New York toll operator desires to establish communication with Rio de Janeiro. She will, therefore, first make sure there is no plug in the Buenos Aires jack and will then insert the calling plug CP of her cord circuit C in the jack 5 (Fig. 4) which is marked in some convenient manner to indicate that its destination is Rio de Janeiro, whereupon relay 6 will operate in an obvious circuit which closes at its upper contacts an obvious energizing circuit for relay 7. When relay 7 operates, it closes at its contacts 8 an obvious circuit to energize relay 9 which relay in operating locks up at its right-hand contacts and connects positive battery, at its contacts 10, over the switch control conductor 11 to cause the positively polarized relay 12 (Fig. 1) to operate and the negatively polarized relay 127 to release, thereby completing a circuit for the operation of relay 13 which locks up at its right-hand contacts. Relay 13 in operating, closes at its contacts 17 a circuit to operate relay 18 which may be traced from battery, contacts 19 of relay 20 and contacts 17 of relay 13 and winding of relay 18 to ground. Relay 18 in operating closes the power circuit to operate motor 16. Relay 13 in operating also closes its contacts 14 to connect battery to the motor direction lead 15 to cause the motor 16 to rotate in the proper direction to operate the antenna switch. Motor 16 now rotates the switch blades 1, 2 and 3 to the right as determined by the energized conductor 15, and when switch blade 3 engages its right-hand contact an obvious circuit is completed to energize relay 20, which in operating locks at its left-hand contact. The operation of relay 20 opens its contacts 19, thereby releasing relay 18 and stopping the motor. Relay 20 operated also connects negative battery at its contacts 60 to signal control conductor 21 to indicate the position of the antenna switch. This negative battery causes positively polarized relay 132 to release and operates negatively polarized relay 22 (Fig. 2), which operates relay 23 which in turn locks up through its left-hand contacts and connects ground through its right-hand contacts over conductor 148 to operate relays 24, 25, 26, 27 and 28. Relay 24 operates busy signal 29 to indicate to any other operator that the circuit is being used. It also transfers operated busy signal 30 from battery at contacts 61 to conductor 31 which is connected to battery by relay 43 which operates at this time in a manner to be described later, thereby keeping signal 30 operated. Relay 25 operated connects 32 to lamp

33, and removes its connection from lamp 34. Conductor 35 is transferred from lamp 4 to lamp 36. Ground on conductor 37, at contacts 38 of relay 9, is connected to relay 39 which operates in an obvious circuit.

When relay 9 first operated it opened its contacts 40, thereby releasing relay 39, which relay, however, is reoperated when relay 25 closes its front contacts. When relay 26 operates, battery through contacts 41 of relay 7 is connected to relay 42 which operates and closes an obvious circuit for relay 43. Relay 43 operates and opens the normally closed circuit for the bridged ringing relay 44 and connects battery to conductor 31, to hold busy signal 30 operated. Busy signals 29 and 30 are now operated, thereby indicating to the operators that the circuit is in use. Also, the service lamp 36 is lighted thus indicating to the operator that the antenna switch has been operated and the transmitter is connected to the Rio de Janeiro antenna.

When relay 27 (Fig. 2) operated the transmission line from the Buenos Aires receiver 150 was transferred from conductors 151 and 152 to conductors 46 and 47, which conductors continue through contacts of relay 48, privacy device 49 and contacts of relays 50 and 51 to monitoring jack 52 at the switchboard and also through the bridged transformer 53 to jack 54 at the control operator's position. Relay 27 operated also transfers the transmission line from the Rio de Janeiro radio receiver 155 from conductors 46 and 47 to conductors 151 and 152 and thence over contacts of relays 56 and 62 through privacy device 63 and then through contacts of relays 64 and 65 to the delay circuit 66 and detector amplifier 67. Relay 28 operated extinguishes lamp 58 and lights lamp 59. Relay 28 operated also transfers privacy control conductor 68 from conductor 69 to conductor 70 and privacy control conductor 71 from conductor 70 to conductor 69. The operator is now in direct connection with the transmitting station and with the Rio de Janeiro receiving station and is ready to ring the Rio de Janeiro operator, which she accomplishes in the usual manner by operating the ringing key RK in her cord circuit which operates relay 72 over a circuit which may be traced over the tip and ring conductors of plug CP, jack 5, contacts of key 73, contacts of jack 74, back contacts of relay 75 and winding of ring-up relay 72. Relay 72 operates, connects ground over contacts of jack 76 and through the windings of relays 77 and 78 to battery, which relays operate. Relay 72 operated also operates relay 79 in an obvious circuit. Relay 77 operated operates relays 80, 81 and 82. Relay 78 operated opens the transmission circuit and terminates each end in terminating resistances 83 and 84. Relay 79 operated connects 1000 cycle signaling current, over contacts of jack 76 and the

operated contacts of relay 80, to the line LT through the hybrid coil 85 and the transmission loss control circuit 95. This signaling current over line LT, passes through the delay circuit 86 and amplifier 87 to open contacts of relay 57. Relay 81 operated adjusts the transmission loss for control 95 to a predetermined value. Relay 82 operated operates relays 62 and 64 in an obvious circuit and lights lamp 96 which serves to indicate to the control operator that the Rio de Janeiro privacy circuit has been removed, which, however, only remains lighted during the ring interval. Relays 62 and 64 operated transfer the line normally extending through the privacy device 63 through compensating resistances 97 and 98.

Bridged across the line LT ahead of the delay circuit 86 is a detector amplifier 88 which detects and amplifies a portion of the ringing current which is passed along over the contacts of relay 89 to operate relays 56, 57, 65 and 90. Relay 56 operated opens the circuit LRR from the Rio de Janeiro radio receiver. Relay 65 operated opens the line LR to the receiving delay circuit 66 and detector amplifier 67. Relay 57 operated closes its contacts to connect the line LT over conductors 91 and 92 to the contacts 93 and 94 of relay 62 and through compensating resistances 97 and 98 and contacts 99 and 100 of relay 64 to conductors 101 and 102 and closed contacts of relay 90 to the transmitting line LTT. This ringing current now passes through the amplifier 103 to the transmitting station 104, where it operates certain apparatus, not shown, to send a signal over the radio circuit to the receiving station at Rio de Janeiro. When the operator releases her ringing key RK, relay 72 releases and all relays operated by this relay are restored to normal. When the Rio de Janeiro operator answers her, voice signals will be received on the receiving antenna 105 and translated in the receiver 155 and applied to the line LRR which extends through the amplifier 106, operated contacts of relay 27, contacts of relays 56 and 62 through the privacy device 63, normal contacts of relays 64 and 65, delay circuit 66, amplifier 107, loss control circuit 108, amplifier 109, hybrid coil 85 and thence over the tip and ring of the two-wire line to the operator's jack and cord circuit. Bridged across the line ahead of delay circuit 66 is a detector 67 which detects and amplifies a small portion of the received voice signals sufficient to operate sensitive relay 89. This relay in operating opens its contacts to prevent any false operation of relays controlled by detector amplifier 88 bridged across the transmitting line LT during receipt of incoming speech currents. When the incoming speech currents cease relay 89 releases and recloses its contacts. When voice currents are transmitted

by the operator at the exchange, these signals cause the operation of detector amplifier 88 which operates relays 56, 57, 65 and 90 to connect the secrecy device 63 in the transmitting circuit and to temporarily open the line LRR from the radio receiver during the transmission of outgoing speech. Detector amplifiers 88 and 67 are alternately energized in response to outgoing and incoming speech, respectively, to control the connection and disconnection of the secrecy device and also to prevent echoes and singing in the radio circuit. These functions, however, form no part of the invention and will not be discussed further. When the conversation is completed the operator will remove her plug CP from the jack 5, thereby releasing relay 6, relay 6 releases relay 7 which in turn releases relay 42, relay 42 in turn releases relay 43, relay 43 released reconnects the bridged ringing relay 44 across the line and removes battery from conductor 31 to release busy signal 30. Busy signal 29 remains operated under control of relay 24 which indicates at this time that the radio circuit is arranged for transmission to Rio de Janeiro. Under this condition busy signal 30 is unoperated to indicate that the circuit to Rio de Janeiro is not busy. Service lamp 36 will be lighted to indicate that the transmitter is connected to the Rio de Janeiro transmitting antenna, and service lamp 4 will be dark, thus indicating that the Buenos Aires antenna is disconnected from the transmitter. Polarized relays 12 (Fig. 1) and 22 (Fig. 2) and relays 24, 25, 26, 27 and 28 remain operated under control of relay 9.

Incoming ring

It will now be assumed that with the circuit in condition for transmitting to Rio de Janeiro but with the switchboard plugs removed from the jacks, the Rio de Janeiro operator rings over the radio channel, which signals are received and translated in the receiver 155 and pass through the amplifier 106, operated contacts of relay 27, and over conductors 110 and 111, normal contacts of relay 80, contacts of jack 76, normal contacts of relay 79 to ring-up relay 112 which operates and connects ground to operate relays 75 and 78. Relay 78 operated again opens the transmission circuit and connects terminating resistances 83 and 84 across the two ends of the line. Relay 75 operated connects 20 cycle ringing current through contacts of jack 74 to the two-wire line extending to the switchboard, where it operates the bridged ringing relay 44 which locks up under control of relays 43 and 113. Relay 44 operated operates relay 114 in an obvious circuit. Relay 114 operated connects battery to conductor 31 to operate busy signal 30 and also connects battery to lead 32 to light the call lamp 33 as an indication to the operator that

Rio de Janeiro is ringing on the circuit. When the operator answers by inserting the plug of her cord circuit into jack 5, relays 6, 7 and 42 operate as previously described. Relay 42 operates relay 43 which relay in operating opens the holding circuit for relays 44 and 114 which relays release and extinguish call lamp 33. Busy signal 30, however, remains operated as previously explained by the operation of relay 43. The conversation may now be carried on as previously described between the New York and Rio de Janeiro operators.

In case the Buenos Aires operator rings while the radio circuit is arranged for transmission to Rio de Janeiro the incoming signals will be translated in the receiver 150 and applied to the line LRB through amplifier 115, operated contacts of relay 27, contacts of jack 116 and the winding of ring-up relay 117 which operates and operates relays 51 and 120 over a circuit including conductor 55 and contacts of jack 119. Relay 51 operated opens the received monitoring line from privacy circuit 49. Relay 120 operated locks up through its left-hand contacts and connects battery through its right-hand contacts and through contacts of relay 121 to lamp 122 which lights as an indication that a ringing signal has been received by the radio receiver not connected to the toll circuit. When an operator inserts the plug of her cord circuit into jack 52 to monitor on the receiver over which a ringing signal has just been received, battery from the sleeve of the cord circuit passes through the sleeve conductor of jack 52, contacts of relay 121 and winding of relay 118 to ground, which relay operates. Relay 118 operated opens the circuit to relay 120 which releases and extinguishes lamp 122. It will be understood that the circuit just described is a monitoring circuit only and the operator is, therefore unable to talk with the distant calling station. She is, however, able to listen on the circuit and in practice a distant call operator will be instructed to repeat any desired message two or three times, which will usually be heard by the New York monitoring operator and in this manner she can very often have the next call ready to be completed when the transmitter circuit is available.

In case the transmitter is idle and a call is received over the monitoring circuit to light lamp 122 which in the case used as an example is from Buenos Aires, the operator will first see that the plug is removed from the Rio de Janeiro jack 5 and she can then, after having plugged into jack 52 and extinguished the monitoring call lamp 122, plug into the regular Buenos Aires jack 123, whereupon battery from the sleeve of the operator's cord circuit operates relay 124, thereby closing an obvious circuit for the operation of relay 125. Relay 125 operated connects ground

from contacts of relay 7 to the battery side of the winding of relay 9 which relay releases as a result of having ground on both ends of its winding. Relay 125 operated also connects battery through its top contacts to open contacts 126 of relay 26 which is now operated. Relay 9 released connects ground at contact 40 to conductor 45 and at its left-hand contacts connects negatively polarized battery to conductor 11 which releases positively polarized relay 12 and operates negatively polarized relay 127. Relay 127 operated short circuit the winding of relay 13 which releases and closes its contacts 128 to place battery on motor direction control lead 129. The release of relay 13 also closes the contacts 130 to complete an energizing circuit for relay 18 which may be traced from battery, contacts 131 of relay 20, contacts 130 of relay 13 and winding of relay 18 to ground. Relay 18 closes the power circuit to operate motor 16 which rotates in the direction determined by the energized direct control lead 129 to rotate the antenna switch arms 1, 2 and 3 from right to left. When contact arm 3 engages its left-hand contact, ground is connected to short-circuit relay 20 which releases and opens the circuit for relay 18 to stop the motor. The release of relay 20 also substitutes positive for negative battery previously supplied to conductor 21 which releases negatively polarized relay 22 and operates positively polarized relay 132. Relay 132 operated short-circuits the winding of relay 23, which releases. Relay 23 released removes ground from conductor 148 thereby releasing relays 24, 25, 26, 27 and 28. Relay 24 released connects battery through its contacts 61 to busy signal 30 which operates and connects busy signal 29 to lead 31. Relay 25 released connects ground on lead 45 through to the winding of relay 39, which reoperates. Relay 25 in releasing also transfers lead 35 from lamp 36 to lamp 4 and transfers lead 32 from lamp 33 to lamp 34. Relay 39 reoperated connects battery to lead 35 and lamp 4 in a circuit which may be traced from battery, operated contacts of relay 113, operated contacts of relay 39, lead 35, normal contacts of relay 25 and through lamp to ground. Lamp 4 lights as an indication to the operator that the Buenos Aires antenna system has been connected to the radio transmitter and the Buenos Aires receiver has been connected to the line LR. Relay 39 reoperated also relights the service lamp 141 at the control operator's position. Relay 26 released closes its contacts 126 to operate relay 42 from battery in a circuit which may be traced from operated contacts of relay 125, contacts 126 of relay 26 and the winding of relay 42 to ground. Relay 42 operated operates relay 43 in an obvious circuit. Relay 43 operated opens the circuit to the bridged ringing relay 44 and connects battery to lead

31 which operates busy signal 29, through normal contacts of relay 24; relay 27 released transfers the transmission line LRB from the monitoring line LRM to the receiving line LR and also transfers the transmission line LRR from the receiving line LR to the monitoring line LRM. This connects the Buenos Aires radio receiver through to the receiving line and the Rio de Janeiro receiver through to the monitoring line in a manner similar to that described before when the Rio de Janeiro receiver was connected through to the receiving line and the Buenos Aires receiver was connected through to the monitoring line. Relay 28 released extinguishes lamp 59 and lights lamp 58 in an obvious circuit to indicate to the control operator that the circuit is now arranged for transmission between New York and Buenos Aires. Relay 28 released also transfers privacy cut-out control conductor 68 from conductor 70 to conductor 69 and privacy control conductor 71 from conductor 69 to conductor 70. A circuit is now arranged for transmission between Buenos Aires and New York in a manner similar to that previously explained for transmission between Rio de Janeiro and New York. Received or transmitted ringing signals and received and transmitted speech signals operate the circuit exactly the same as previously described when the circuit was arranged for transmission to Rio de Janeiro.

It will be understood that the so-called control or technical operator, who may or may not be located in the same building as the regular toll operators, exercises control of the circuit at any and all times and is, therefore, provided with various jacks whereby he is enabled to cut in on the circuit as desired and is also enabled to perform various other functions by means of keys such as privacy cut-out keys 133 or 134 and also to completely disable either the Buenos Aires or Rio de Janeiro links, i. e., prevent incoming signals from either of the distant radio stations from being received and also to prevent the New York toll operator from gaining control of either of the radio transmitting circuits. This function is performed by cut-out keys 135 and 136, key 135 serving to disable the Buenos Aires receiver and prevent the New York operator from connecting the transmitter to the Buenos Aires transmitting antenna, and key 136 serving to disable the Rio de Janeiro receiver and prevent the New York toll operator from connecting the transmitter to the Rio de Janeiro transmitting antenna. In case the control operator desires to take the circuit away from the operator who may be in communication with either Buenos Aires or Rio de Janeiro, keys 137 and 138 are provided. Operation of key 137 functions to shift the transmitter to the Rio de Janeiro transmitting antenna in case

the operator is talking with Buenos Aires. Operation of key 138 transfers the transmitter to the Buenos Aires transmitting antenna in case a conversational connection has been established between the toll operator and Rio de Janeiro. It will be noted that operation of key 137 or 138 performs the same function as the insertion of the plug CP of a toll cord into either jack 5 or 123, i. e., they control the operation or release of the switch control relay 9. Keys 137 and 138 are not operated unless the control operator desires to transfer the transmitter from one transmitting antenna to the other. If the control operator desires to take control of the circuit but does not wish to transfer the transmitter from one antenna to the other, it is only necessary for him to operate his talk key 139 which causes the following operations to take place. Talk key 139 operated opens the circuit of relay 140 and 113 which are normally operated. Relay 140 released extinguishes the service lamp 141. Relay 113 released removes battery from service lamp 4 or 36 depending upon which radio receiver and transmitting antenna are connected to the transmission circuit. Relay 113 released also connects battery over lead 31 to operate either busy signal 29 or 30 depending upon which transmitting antenna or radio receiver is connected to the transmission system. This indicates to the switchboard operator that neither the radio circuit to Buenos Aires nor Rio de Janeiro is available for service. Operation of the control operator's talk key 139 also connects the tip and ring conductors of the two-wire transmission circuit into his telephone set circuit 153. By means of key 73 the control operator is able to split the circuit and talk in either direction, i. e., toward the switchboard or toward the radio circuit. The operation of key 73 to the right connects the radio side of the transmission circuit to the operator's telephone set 153 and bridges ring-up relay 142 across the tip and ring of the transmission circuit to the switchboard. This enables the control operator to talk on the radio circuit and if the switchboard operator rings on the circuit, ring-up relay 142 will operate and lock up from ground through contacts 143 of key 73 and also operates relay 144 which locks up under control of key 73. Relay 144 operated lights the call lamp 145 at the control operator's position as an indication that the switchboard operator wishes to originate a call. When key 73 operates to the left the control operator is enabled to talk toward the switchboard and ring-up relay 146 is bridged across the transmission circuit from the radio receiver. If a ringing signal is received over the radio circuit under this condition relay 146 operates and locks up from ground through contacts 147 of key 73 and operates

relay 144 as before. Relay 144 operated lights lamp 145 as an indication to the control operator that a ringing signal has been received over the radio circuit.

5 What is claimed is:

1. In a radio telephone system, a radio transmitter, a first transmitting antenna directive in a predetermined direction, a second transmitting antenna directive in a predetermined other direction, switching means for connecting the transmitter to either of the antennæ, a telephone switchboard, a line extending between said switchboard and said transmitter adapted to control the transmitter, two jacks at the switchboard for making connection with said line, an operator's cord and plug for making connection with either of said jacks and means selectively and automatically responsive to such connection to actuate said antenna-switching means to switch the transmitter into connection with one or the other of said antennæ depending on the jack connected to.

2. In a radio telephone system, a radio transmitter, a first transmitting antenna directive in a predetermined direction, a second transmitting antenna directive in a predetermined other direction, switching means for connecting the transmitter to either of the antennæ, a telephone switchboard, a line for controlling said transmitter extending between said switchboard and said transmitter having two terminals at the switchboard, a link circuit at the switchboard for connecting to one or the other of said line terminals and means selectively and automatically operable, responsive to connection of said link to one or the other of said terminals to actuate said antenna-switching means to switch said transmitter into connection with one or the other of said antennæ depending on which line terminal said link is connected to.

3. In a radio telephone system, a radio transmitter, a first transmitting antenna directive in a predetermined direction, a second transmitting antenna directive in a predetermined other direction, switching means for connecting the transmitter to either of the antennæ, a telephone switchboard, a line extending between said switchboard and said transmitter adapted to control the transmitter, two jacks at the switchboard making connection with said line, an operator's cord and plug for making connection with either of said jacks, means selectively and automatically responsive to such connection to actuate said antenna-switching means to switch the transmitter into connection with one or the other of said antennæ depending on the jack connected to, a signal device associated with each of said jacks and means operated when said switching function has been accomplished to operate the signal associated with the jack connected to.

4. In a radio telephone system, two transmitting antennæ directive in different directions, a transmitter, means for switching the transmitter into connection with one or the other of said antennæ, a telephone switchboard connected by means of a line to said transmitter, two jacks in the switchboard for making connection to said line and means selectively and automatically operated when one or the other of said jacks is employed, to control the switching of said transmitter to one or the other of said antennæ.

5. In a radio communication system, a two-way communication circuit, a plurality of two-way communication circuits remote therefrom, a radio transmitter, a plurality of directive transmitting antennæ each adapted for transmission to a respective one of said remote two-way circuits, a plurality of directive receiving antennæ each adapted for communication with a respective one of said remote two-way communication circuits and means associated with said first-mentioned communication circuit for connecting said circuit through said radio transmitter with a desired one of said directive transmitting antennæ and for connecting said circuit with a corresponding receiving antenna.

6. In a two-way radio telephone system, a plurality of distant radio stations each comprising a transmitting and a receiving antenna, a near radio station comprising a separate receiving system for each of the distant transmitting antennæ, and a separate directional transmitting antenna for each of the distant receiving antennæ and directed to transmit only to its corresponding distant receiving antenna, a single radio transmitting circuit for said plurality of directional antennæ, switching means for connecting the transmitting circuit to any one of the directional antennæ, a telephone switchboard, a line connecting said switchboard and transmitting circuit for controlling said circuit, said line terminating in the switchboard in a plurality of jack terminals, one for each directional antenna, an operator's cord and plug for making connection to said line through any one of said jacks, means selectively and automatically responsive to such a connection to actuate said switching means to connect a particular one of said directional antennæ to said transmitting circuit depending on the jack selected and means automatically actuated when a particular directional antenna is connected to the transmitting circuit to connect the receiving antenna at the near station, corresponding to the distant transmitting antenna toward whose corresponding receiving antenna the switched directional antenna is directed, to said line extending to the switchboard.

7. In a radio telephone system, a plurality of directive radio receiving systems, a tele-

phone switchboard, a switching point common to said receiving systems, a line extending between said switching point and switchboard, means at said switching point for interchangeably connecting any one of said receiving system to said line, a multiple appearance of said line at said switchboard for each receiving system, and means selectively and automatically responsive to seizure of said line for use at any one of its switchboard appearances to cause said switching means to connect a predetermined one of said receiving systems to said line depending upon the line appearance seized.

8. In a radio telephone system, two differently directive transmitting antennæ, a transmitter, a corresponding receiving system for each of said antennæ, means for switching the transmitter into connection with one or the other of said antennæ, a telephone switchboard connected by means of a line to said transmitter, multiple appearances of said line at the switchboard for making connection therewith, means selectively and automatically operated, depending upon the line appearances connected with, to control the switching of said transmitter to one or the other of said antennæ in a predetermined manner and switching means actuated in response to the operation of said antenna-switch to connect the receiving system, corresponding to the switched antenna, to the line.

9. In a radio telephone system, two differently directive transmitting antennæ, a transmitter, a corresponding receiving system for each of said antennæ, means for switching the transmitter into connection with one or the other of said antennæ, a telephone switchboard connected by means of a line to said transmitter, a monitoring circuit, multiple appearance of said line at the switchboard for making connection therewith, means selectively and automatically operated, depending upon the line appearance connected with, to control the switching of said transmitter to one or the other of said antennæ in a predetermined manner, and switching means actuated in response to the operation of said antenna-switch to connect the receiving system, corresponding to the switched antenna, to the line, and to connect the other receiving system to the monitoring circuit.

10. In a radio telephone system, two transmitting antennæ, a radio transmitter terminating in a switching device, said switching device having a contact for each of said transmitting antennæ, a telephone switchboard connected by means of a line to said transmitter, said line terminating at said switchboard in two jacks, each jack corresponding to one of said transmitting antennæ, and means responsive to the seizure of said line at said switchboard for effect-

ing the actuation of said switching device in a certain manner to cause said transmitter to be connected with the transmitting antennæ corresponding to the jack employed in seizing the line.

In witness whereof, we hereunto subscribe our names, this 14th day of August, 1931.

HAROLD M. PRUDEN.
CHARLES C. TAYLOR.

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