May 3, 1949. W. R. AIKEN 2,468,911

COMMUNICATION SYSTEM

Filed Oct. 19, 1945 3 Sheets-Sheet 1

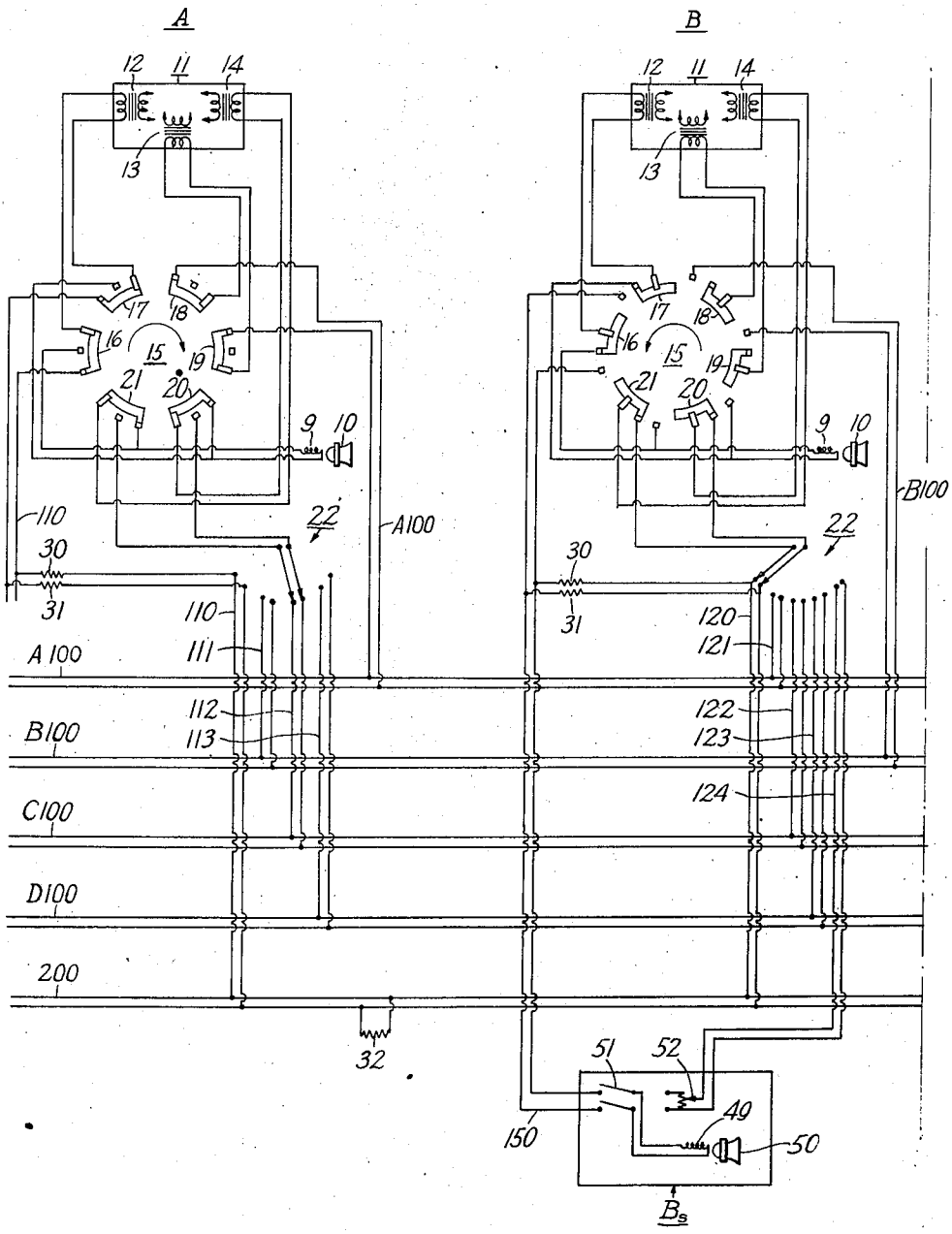


FIG. 1.

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COMMUNICATION SYSTEM

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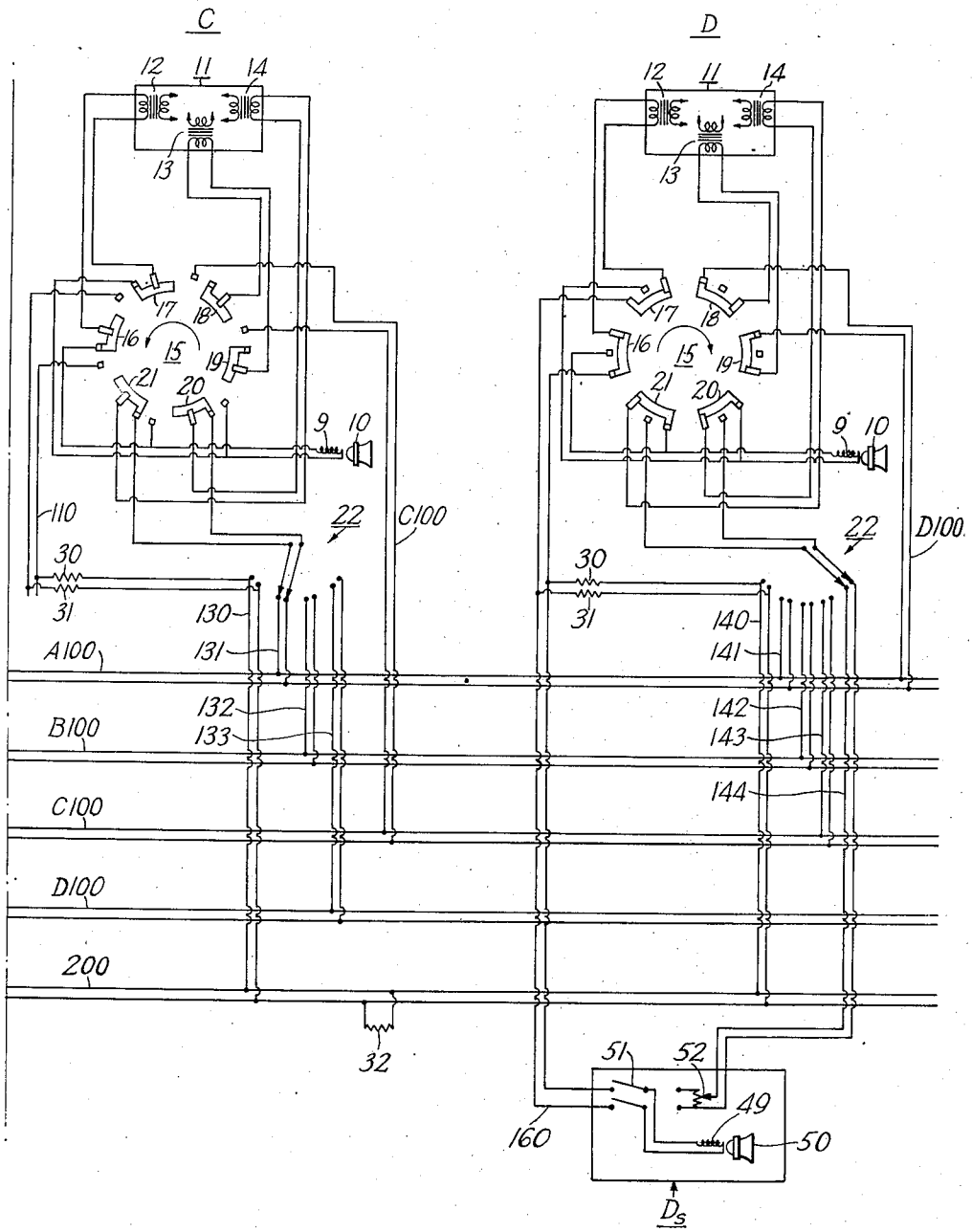


FIG. 1A.

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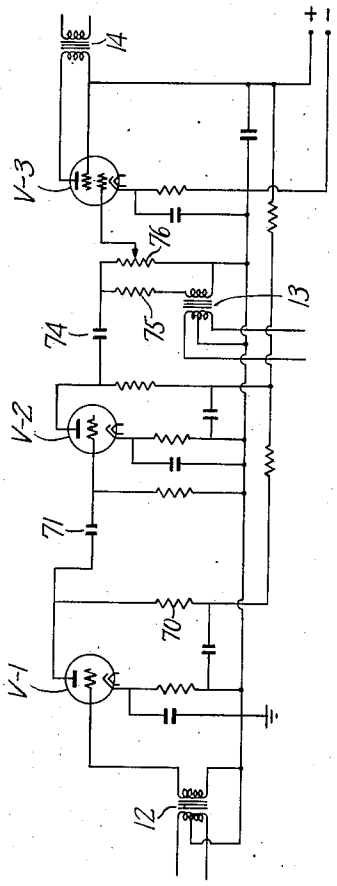


FIG. 2.

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Patented May 3, 1949 2,468,911

UNITED STATES PATENT OFFICE

2,468,911

COMMUNICATION SYSTEM

William Ross Aiken, Berkeley, Calif.

Application October 19, 1945, Serial No. 623,233

15 Claims. (Cl. 179—1)

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The present invention relates to intercommunication systems of the type enabling selective communication amongst a plurality of stations such as may be used in offices, factories, ships, garages, or similar establishments. Such systems usually include one or more master stations having individual amplifiers and each master station may in turn be provided with a number of subordinate stations which have no amplifiers of their own and which are generally termed "remote-stations" or "substations." Intercommunication systems of this kind frequently employ sound translating devices of the type known as "back-talk" loudspeakers which are capable of being interchangeably utilized both as microphone and loudspeaker depending upon the position of a manually operated talk-listen switch.

One of the critical problems of such systems is the problem of providing proper amplification of a transmitted signal to guarantee satisfactory reception under a plurality of varying conditions, without having to resort to powerful and expensive amplifiers and complex and costly switching means.

Thus, when such systems are designed to provide amplification of a signal in the amplifier of the transmitting station only with the amplified signal being applied directly to the loudspeaker circuit of the receiving station, the load placed upon the loudspeaker circuit by its inactive amplifier renders reception practically impossible; and even if means were devised to overcome this defect the power produced in such an arrangement would be too weak to permit proper reception in case so-called conference connections are established; that is, when a master station desires to talk to a plurality of other master stations simultaneously. To meet this situation it would be necessary to employ amplifiers of sufficient power to produce proper response in a plurality of listening stations simultaneously in combination with complicated control means to appropriately control amplification depending on the number and the nature of the stations to be addressed, all of which is costly and requires complex manipulation of the station controls.

On the other hand, if the intercommunication systems under discussion are designed to feed a signal through the amplifiers of both the transmitting and the receiving station so as to secure an adequate degree of amplification for all conditions of communication, reception is unpleasantly loud and distorted in master-station-to-master-station conversation, because application of an amplified signal to the input of the amplifier in the receiving station results in overloading of said amplifier since its input is designed for the reception of such low voltages only as are produced by speech in the heretofore mentioned sound translating devices.

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Finally, when such systems are designed to confine amplification of a signal to the amplifier in the receiving station, reception is poor due to an unfavorable signal to noise ratio resulting from the fact that not only the signal but also disturbances picked up by the intercommunication lines are amplified in the amplifier of the receiving station and are thus amplified to an equal extent. To secure satisfactory reception in such arrangements, it is therefore necessary to specially shield the intercommunication lines, which is inconvenient and costly.

It is an object of the present invention to provide a communication system and station units of the type referred to, wherein satisfactory reception is obtained without the necessity of operating any special controls, no matter whether a master station addresses one or several master stations or whether a master station is addressed by another master station or a substation.

It is an additional object of the present invention to provide a communication system of the kind here contemplated wherein satisfactory reception is obtained without the necessity of specially shielding the intercommunication lines.

It is another object of the present invention to provide an intercommunication arrangement of the type under discussion wherein substantially the same sound level of reproduction is automatically secured in any one of its stations for any and all of the communication connections possible in a system of this kind.

More specifically, it is an object of the present invention to provide a communication system of the type referred to, which while avoiding the harmful effects of double amplification in talking from master station to master station, assures proper amplification of a transmitted message when addressing a plurality of stations, without requiring in any of its stations amplifiers of a larger size than would normally be employed.

It is an additional object of the present invention to provide a station unit for systems of the type referred to, adapted to produce proper reproduction of all types of signals supplied thereto without manipulation of any other controls than the ordinary talk-listen and station selector switches.

It is still another object of the present invention to furnish a master station unit for em-

ployment in systems of the type referred to, which assures proper reproduction of outgoing signals in subordinate stations and automatically provides different degrees of amplification for arriving signals depending on their character; that is, on whether they originate in other master stations or substations and on whether they are received individually or shared with other stations.

Moreover, it is an object of the present invention to provide switching means in combination with wiring arrangements for intercommunications systems and station units of the type described enabling establishment of the necessary connections between the amplifiers and intercommunication circuits of the invention with a minimum amount of manipulation.

It is still another object of the present invention to provide circuit arrangements in combination with simple switching means for intercommunication systems of the kind under discussion permitting establishment of private station-to-station connections in such a manner as to practically exclude the possibility of eavesdropping.

Other objects of the invention will be apparent from a description of the accompanying drawing, which illustrates by way of example a preferred embodiment of the present invention, and in which

Figures 1 and 1*a* show two sections of one and the same circuit diagram of a multi-station communication system according to the present invention, and

Figure 2 is a detailed diagram of an electronic amplifier such as may be employed in the master stations of the present invention.

Figures 1 and 1*a* show a communication system having four master stations collectively identified with the letters A, B, C, and D; stations B and D each being provided with a subordinate station B_S and D_S respectively. For the sake of simplicity master station A will primarily be referred to, it being understood that every one of the other master stations is of similar construction, corresponding elements of said other master stations being identified by the same reference numerals associated with letters designating the stations to which they belong.

Reference numeral **10** indicates a sound translating device known as "back-talk loudspeaker" which is capable of being interchangeably used as receiver or as microphone; **11** is an electronic multistage amplifier having an initial or omnistage input transformer **12**, an interstage input transformer **13**, and an output transformer **14**. Signal voltages introduced through omnistage input transformer **12** are applied to the grid of a first amplifier tube V_1 (Figure 2) reappear in amplified form across resistor **70** in the plate circuit of tube V_1 and are applied through coupling condenser **71** to the grid of tube V_2 where the process is repeated with respect to tube V_3 with the fully amplified voltage appearing across output transformer **14**. In the example illustrated in Figure 2, the secondary winding of interstage input transformer **13** is connected in the grid circuit of the third tube V_3 in series with a grid resistor **75**. Thus voltages supplied through interstage input transformer **13** as well as voltages supplied from the preceding stage through coupling condenser **74** are applied to the grid of tube V_3 to emerge in amplified form across output transformer **14**. An additional resistor **76** may be provided in the grid circuit of tube V_3 in

connection with resistor **75** as shown. Resistor **76** is preferably variable to adjust the voltages supplied to the grid of tube V_3 so as to determine the volume of reproduction in loudspeaker **10**. It will be understood that audio-amplifiers of many different designs and including varying numbers of stages may be adapted to serve the purposes of my invention.

Reverting to Figures 1 and 1*a*, each master station has a manually operated two-position switch **15** of the type known as "talk-listen switch" which in the counter-clockwise position illustrated in stations A and D connects the station for reception, and in the clockwise position illustrated in stations B and C for transmission. Switches of this type are usually spring-urged into listening position and during conversation are manually displaced into their talking position. Switch **15** possesses a movable base of insulating material which carries three pairs of conductive connector plates **16** and **17**, **18** and **19**, and **20** and **21**, respectively, each cooperating with three stationary contact points to establish the circuit connections in accordance with the present invention. When in clockwise or talking position (illustrated in stations B and C), contact plates **16** and **17** connect the two leads of back-talk loudspeaker coil **9** to the ends of the primary winding of omnistage input transformer **12**, while contact plates **18** and **19** establish no conductive connections, and contact plates **20** and **21** connect the two leads of the secondary winding of output transformer **14** to a double-pole station selector switch **22** of suitable design. Station selector switch **22** has as many contact positions as there are other master stations in the intercommunication system, plus the number of substations associated with a particular master station, and plus an additional contact position leading to what may be termed a conference line. In the particular system illustrated by way of example in Figures 1 and 1*a*, the station selector switches **22** of stations A and C, therefore, have each four contact positions, while the station selector switches **22** of stations B and D have each five contact positions.

Reverting to talk-listen switch **15** of master station A, when said switch is set to its counter-clockwise or listening position (as illustrated in stations A and D) contact plates **20** and **21** connect the two leads of loudspeaker coil **9** to the output terminals of output transformer **14**, while contact plates **18** and **19** connect the two leads of what may be termed the master listening or reception line **100** of master station A to the primary winding of interstage input transformer **13**, and contact plates **16** and **17** connect the two leads of a listening branch **110** of conference line **200** to the primary winding of the omnistage input transformer **12**.

The communication system of the present invention includes a master listening line for every master station present. For master station A this line is identified by reference numeral **A100**, while the lines appertaining to master stations B, C and D are designated with the reference numerals **B100**, **C100**, and **D100**, respectively. Each of these lines is connectible to the interstage input transformer **13** of its associated master station by setting the respective talk-listen switch **15** to listening position, but is disconnected from its station when talk-listen switch **15** is set to talking position.

In the system of the present invention every one of the master stations has a plurality of

feeder lines, each connecting one of the selection contacts or terminals of station selector switch 22 to one of the master listening lines provided for the other master stations. Thus, when the talk-listen switch of, say, master station C is set to talking position and its station selector switch C22 is set to the contact terminals of feeder line 131 leading to master listening line A100, as illustrated in Figure 1a, and when talk-listen switch A15 of station A is in listening position, as shown in Figure 1, a signal originating in the loudspeaker C10 of master station C will become audible in the loudspeaker A10 of master station A through the following circuits formed by the described settings of station selector switch C22 and talk-listen switches C15 and A15. The input circuit of amplifier C11 extends from loudspeaker coil C9 across contact plates C16 and C17 of talk-listen switch C15 to the primary winding of omnistage input transformer C12. The signal amplified by the full power of amplifier C11 emerges from the output transformer C14 and is supplied to the interstage input transformer A13 of master station A by an intercommunication circuit extending from the secondary winding of output transformer C14 across contact plates C21 and C20 of talk-listen switch C15 to station selector switch C22, and through feeder line 131, master listening line A100, across contact plates A18 and A19 of talk-listen switch A15 to the primary winding of interstage input transformer A13. The signal supplied to interstage input transformer A13 is amplified by the last amplifier stage provided in amplifier A11, and emerges at the output transformer A14, from where it is supplied to the loudspeaker A10 by an output circuit extending from the secondary winding of output transformer A14 across contact plates A21 and A20 of talk-listen switch A15 to loudspeaker coil A9. Thus a call originating in back-talk loudspeaker C10 is fully amplified in station C, but enjoys only part of the amplification of which the amplfier A11 of station A is capable; hence, response in loudspeaker A10 will not be too loud and overloading of amplifier A11 is avoided because the amplified voltage is not supplied to the low level omnistage input of amplifier A11 which is designed for the reception of weak voltages such as are derived from loudspeakers but is applied to a higher level stage in the succession of amplifier stages which is capable of handling larger voltages, since it is designed to receive the amplified signal voltages of its preceding stages. At the same time, by feeding the incoming signals through the last stage of the amplifier in the receiving station instead of supplying it directly to the loudspeaker circuit, the harmful absorption effect is avoided that an inactive amplifier would have upon the loudspeaker circuit. Additionally, since most of the amplification of the transmitted signal occurs in the transmitting station, a favorable signal to noise ratio is obtained without the need of specially shielding the intercommunication line.

Moreover, due to the fact that master listening line A100 is connectible to input terminals of station A only and to no other input terminals, no other master station can listen to messages transmitted from master station C to master station A, no matter how their talk-listen and station selector switches may be operated.

Now for station A to answer station C, station selector switch A22 is set to the contact terminals of feeder line 112 leading into master

listening line C100 of station C, which is preferably done at the beginning of a conversation. Then during conversation the party at station A merely moves talk-listen switch A15 clockwise to talking position, while the party at station C moves talk-listen switch C15 counterclockwise to listening position, and party A may speak to party C while excluding any other station from listening in, through connections reversely corresponding to those described above.

As previously indicated, the system of the present invention provides for conference conversation among any number of stations that may wish to take part therein. For this purpose a conference line 200 is provided, through which calls may be transmitted in either direction and which has as many feeder branches, designated with 110, 120 130 and 140, respectively, as there are master stations in the system. Each branch 110, 120, 130, and 140, respectively, is preferably connectible to omnistage input transformer 12 of amplifier 11 of its master station by setting the talk-listen switch 15 of the respective station to listening position, as previously explained. It will be understood that in systems comprising a relatively small number of master stations it may suffice to connect the feeder branches of the conference line to the interstage inputs of the various master stations. Thus, any master station may listen to any call transmitted through conference line 200. For enabling a master station to speak through conference line 200, special contact points are provided for station selector switch 22 to establish connection between back-talk loudspeaker 10 through all of amplifier 11 to conference line 200 when talk-listen switch is set to talking position. In the particular embodiment illustrated in Figures 1 and 1a, a part of the above-mentioned feeder branch 110, 120, 130 or 140, respectively, of conference line 200 has been employed for this purpose in each of the stations by providing taps at appropriate places thereof which serve as conference contacts for station selector switch 22. Thus, with talk-listen switch 15 set to talking position and station selector switch set to contact the above-mentioned taps of feeder line 110, 120, 130, or 140, respectively, any master station may speak into conference line 200, station B being shown in such a position of adjustment. There a signal introduced through loudspeaker B10 is fed to the omnistage input B12 of amplifier B11 across contact plates B16 and B17 of talk-listen switch B15. It emerges in amplified form from output B14 of amplifier B11 and is carried across contact plates B20 and B21 to station selector switch B22, whose blades contact the above described taps of feeder line 120, thus feeding the signal through the lower part of feeder line 120 into conference line 200. In the illustrated embodiment stations A and D are in condition to listen to conference calls from station B. Part of the power supplied by amplifier B11 will reach the omnistage input of amplifier A11 along feeder branch 110 and across talk-listen switch contact plates A16 and A17. In amplifier A11 the signal will again be fully amplified and will then be fed through switch plates A20 and A21 to loudspeaker A10. Another part of the power supplied by amplifier B11 will be fed over a corresponding path to loudspeaker D10 of station D. In order to assure proper distribution of the power available in conference line 200, over all listening stations, and to avoid overloading of the amplifiers of listening master stations, resistors 30 and 31 of relatively large resistance

are interposed in feeder lines 110, 120, 130 and 140, respectively, at places where they restrict current flow to the omnistage input of the station amplifiers but do not interfere with the power supplied from amplifier output 14 through station selector switch 22 to the conference line 200 in case a master station is adjusted for talking into the conference line.

Thus, in the system just described, although no amplifiers of especially large size are provided for conference conversation, proper reproduction is automatically obtained in the loudspeakers of all listening stations taking part in a conference conversation, no matter how large their number, due to the fact that the amplifiers of all communicating stations are made to cooperate to produce the proper amount of power required in the individual listening stations. Appropriate resistors 32 may be provided between the two leads of conference line 200 to balance a particular intercommunication system and to make allowance for further master stations which it may become desirable to add to the system at a later date.

In the embodiment illustrated in Figure 1, master stations B and D both have a subordinate or remote station designated with B_s and D_s respectively. Each substation has a back-talk loudspeaker 50 of a construction similar to that of back-talk loudspeakers 10 in the master stations. Loudspeaker 50 is associated with a two-pole double-throw talk-listen switch 51, which in its lefthand, or talking, position connects the loudspeaker circuit to a line 150 or 160, respectively, leading into listening branches 120 or 140, respectively, of conference line 200. Hence with the talk-listen switch 51 of a substation set to talking position and the talk-listen switch 15 of its master station set to listening position, any call originating in loudspeaker 50 is supplied to the omnistage input transformer 12 of the respective master station across contact plates 16 and 17 of talk-listen switch 15, is fully amplified in amplifier 11 and appears in amplified form at output transformer 14, from where it is fed in the usual manner to loudspeaker 10. The positions of the previously mentioned resistors 30 and 31 relative to the junction of lines 150 and 120 or 160 and 140, respectively, and the sizes of these resistors are so chosen that they effectively inhibit leakage into the conference line of the power derived from loudspeaker 50, and since any current derived from loudspeaker 50 of a substation and which might leak through resistors 30 and 31 of its respective master station into conference line 200 would have to pass another set of resistors 30 and 31 in the listening branch of whatever master station might attempt to eavesdrop through the conference line, any power derived from loudspeaker 50 that might reach the amplifier of another master station but its own, would be so infinitesimally small as to produce no audible response in such an eavesdropping master station.

When talk-listen switch 51 is thrown to the right, it connects loudspeaker coil 49 through a variable resistor 52 to a feeder line 124 or 144, respectively, joined directly to one of the contacts of selector switch 22 in the respective master station. Thus the master station may call its substation by exactly the same simple switching manipulations carried out when calling another master station; that is, by setting its talk-listen switch 15 to talking position and setting its selector switch 22 to the contacts of the feeder line leading to its substation, the circuit connections in the master station being entirely analogous to those established when a master station is set for talking to another master station. Variable resistor 52 in the substation need only be set once to adjust the reception in its loudspeaker 50 to a desired volume level.

With the arrangement just described, calls from a master station to its substation are amplified in the calling station and then supplied directly to the loudspeaker of the substation, while the weak signals originating in the substation loudspeakers which have no amplifiers of their own are automatically fed through the total amplifier of the listening station (contrary to calls from master station to master station) and thus produce proper response in the loudspeaker of the receiving master station. Hence, though the substations have no amplification of their own, outgoing and incoming calls may be received at substantially the same sound levels in the loudspeakers of the master station and the substation, respectively. Moreover, by proper choice of the value of grid resistor 75 in series with the secondary winding of interstage input transformer 13 (Figure 2) and/or by proper choice of the transformer ratio itself it is possible to appropriately reduce the signal voltage supplied from another master station to the grid of the last amplifier tube (and which has previously passed through all three amplifier stages of the transmitting master station), so that signals received from a master station and signals received from a sub-station may be applied to the loudspeaker of the listening station at practically the same voltage level with the result that the same sound level is obtaind in a listening master station whether the incoming signal originates in another master station or in a sub-station.

The above-described arrangement of the present invention requires no more manipulation than the simple two-way setting of the talk-listen switch and the selection setting of the station selector switch whether a conversation occurs between a master station and its substation or between a master station and one or several other master stations. It does not necessitate the use of any amplifiers of larger size than normally employed in systems of this type, nor does it require the manipulation of complex switching arrangements for sound control or the provision of special shielding for the intercommunication lines, and yet it assures proper reproduction of all transmitted signals at a favorable signal to noise ratio, response being neither too weak nor too noisy or distorted, no matter whether received in a master station or in a remote station, and no matter whether received singly under conditions of secrecy, or simultaneously by a plurality of stations in conference conversation.

It will be understood that the showing of the drawing illustrates only an example of my invention which may be departed from without departing from the scope of my invention.

Having thus described my invention and the manner in which it is to be performed, what I claim is:

1. For a multistation intercommunication system, a station unit including a sound translating device, a multistage amplifier possessing an omnistage input, an interstage input and an output, a reception line for weak signals, a reception line for strong signals, a transmission line and means including a talk-listen switch whereby

in one position of adjustment of said switch said sound translating device is connected to said omnistage amplifier input while said amplifier output is connected to said transmission line and whereby in another position of adjustment of said switch said reception line for weak signals is connected to said omnistage amplifier input and said reception line for strong signals is connected to said interstage amplifier input and said amplifier output is connected to said sound translating device.

2. For an intercommunication system of the type having master stations and remote stations and permitting establishment of conference connections, a master station unit including a sound translating device, a multistage amplifier possessing an omnistage input, an interstage input and an output, a first line for the reception of master station calls, a second line for the reception of remote station and conference calls, a station selector switch and means including a talk-listen switch whereby in one position of adjustment of said talk-listen switch said sound translating device is connected to said omnistage amplifier input while said amplifier output is connected to said station selector switch and whereby in another position of adjustment of said talk-listen switch said first line is connected to said interstage amplifier input and said second line is connected to said omnistage amplifier input and said amplifier output is connected to said sound translating device.

3. For a multistation intercommunication system, a station unit including a sound translating device, a multistage amplifier possessing an omnistage input, an interstage input and an output, a plurality of talking line terminals, a station selector switch settable to any one of said talking line terminals, an individual listening line, a conference line branch including an attenuating resistor and means including a talk-listen switch whereby in one position of adjustment of said talk-listen switch said sound translating device is connected to said omnistage amplifier input while said amplifier output is conected to said station selector switch and whereby in another position of adjustment of said talk-listen switch said individual listening line is connected to said interstage input and said conference line is connected to said omnistage input, and said amplifier output is connected to said sound translating device.

4. For a multistation intercommunication system, a station unit including a sound translating device, a multistage amplifier possessing an omnistage input, an interstage input and an output; a plurality of talking line terminals, a selector switch settable to any one of said terminals, an individual listening line, a conference line branch, a tapping point provided in said branch and arranged to form one of the terminals of said selector switch, and means including a talk-listen switch whereby in one position of adjustment of said talk-listen switch said sound translating device is connected to said omnistage amplifier input, while said amplifier output is connected to said selector switch and whereby in another position of adjustment of said talk-listen switch said individual listening line is connected to said interstage amplifier input and said conference line branch is connected to said omnistage amplifier input and said amplifier output is connected to said sound translating device.

5. For a multistation intercommunication system of the type having master stations and substations, a master station unit including a sound translating device, a multistage amplifier possessing an omnistage input, an interstage input and an output, a plurality of talking line terminals, a station selector switch settable to any one of said terminals, a line for the individual reception of other master stations, a conference line branch, a substation reception line connected to said conference line branch, and means including a talk-listen switch whereby in one position of adjustment of said talk-listen switch said sound translating device is connected to said omnistage amplifier input while said amplifier output is connected to said station selector switch and whereby in another position of adjustment of said talk-listen switch said individual reception line is connected to said interstage amplifier input and said conference line branch is connected to said omnistage amplifier input, and said amplifier output is connected to said sound translating device.

6. For an intercommunication system of the type having master stations and substations, a master station unit including a back-talk loudspeaker, a multistage amplifier possessing an omnistage input, an interstage input and an output, a plurality of talking line terminals for connection with other stations, a station selector switch settable to any one of said terminals, a line for the indiviual reception of other master stations, a conference line branch, a tapping point provided in said branch and arranged to form one of the terminals of said selector switch, means including a talk-listen switch whereby in one position of adjustment of said talk-listen switch said loud-speaker is connected to said omnistage amplifier input while said amplifier output is connected to said station selector switch and whereby in another position of adjustment of said talk-listen switch said individual reception line is connected to said interstage amplifier input and said conference line branch is connected to said omnistage amplifier input and said amplifier output is connected to said loudspeaker, and a substation reception line joined to said conference line branch at a point closer to said omnistage input than said tapping point, a resistor being interposed in said conference line branch between said junction point and said tapping point.

7. An intercommunication system including a plurality of amplifiers each having a low level input and a high level input, an equal number of first lines one each connected to the high level input of one of said amplifiers and a second line having branches connecting said second line to the low level inputs of all of said amplifiers.

8. A system according to claim 7 wherein each of said branches includes a resistor.

9. An intercommunication system including a plurality of amplifiers each possessing a low level input and a high level input, an equal number of first lines each one connected to the high level input of one of said amplifiers, a second line having branches connecting said second line to the low level inputs of all of said amplifiers and a third line connected to one of said branches.

10. An intercommunication system including a plurality of amplifiers each possessing a low level input and a high level input, an equal number of lines each one connected to the high level input of one of said amplifiers, a second line having branches connecting said second line to the low level inputs of all of said amplifiers, each branch including a resistor, and a third line connected

to one of said branches at a point nearer to the corresponding low level input than the resistor provided in the particular branch.

11. For a multistation intercommunication system, a station unit including a sound translating device, a multistage amplifier possessing an omnistage input, an interstage input and an output, a reception line, a transmission line and means including a talk-listen switch whereby in one position of adjustment of said switch said sound translating device is connected to said omnistage amplifier input, while said amplifier output is connected to said transmission line and whereby in another position of adjustment of said switch said reception line is connected to said interstage amplifier input and said amplifier output is connected to said sound translating device.

12. A communication system including a plurality of stations, an intercommunication line and attenuating means disposed between each of said stations and said line, each of said stations having a loudspeaker, an amplifier possessing an input and an output and means including a talk-listen switch whereby in one position of adjustment of said switch said loudspeaker is connected to said amplifier input, while said amplifier output is directly connected to said line, and whereby in another position of adjustment of said switch said line is connected to said amplifier input through said attenuating means and said amplifier output is connected to said loudspeaker.

13. For a multistation communication system a station unit including a loudspeaker, an amplifier having a plurality of inputs designed for different voltage levels and an output, a communication line terminal, and means including a talk-listen switch whereby in one position of adjustment of said switch said loudspeaker is connected to a low voltage level input of said amplifier inputs while said amplifier output is connected to said communication line terminal and whereby in another position of adjustment of said switch said communication line terminal is connected to one of said amplifier inputs and said amplifier output is connected to said loudspeaker.

14. A communication system including a plurality of stations, attenuating means associated therewith, and an intercommunication line, each of said stations having a talk-back loudspeaker, an amplifier possessing an input and an output, and means including a talk-listen switch, whereby in one position of adjustment of said switch said loudspeaker is connected to said amplifier input and said amplifier output is connected to said line while effectively disconnecting said attenuating means, and whereby in another position of adjustment of said switch said line is connected to said amplifier input and said amplifier output is connected to said loudspeaker while effectively connecting said attenuating means into said system.

15. A communication system including a plurality of stations, attenuating means associated therewith, and an intercommunication line, each of said stations having a talk-back loudspeaker, an amplifier possessing an input and an output, means including a talk-listen switch whereby in one position of adjustment of said switch said loudspeaker is connected to said amplifier input, while said amplifier output is connected to said line, and whereby in another position of adjustment of said switch said line is connected to said amplifier input and said amplifier output is connected to said loudspeaker, and means controlled by said talk-listen switch to render said attenuating means ineffective when said loudspeaker is connected to said amplifier input.

WILLIAM ROSS AIKEN.

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