Sept. 26, 1950 A. W. VINCENT 2,523,671

INTERCOMMUNICATING SYSTEM

Filed Jan. 25, 1949 2 Sheets-Sheet 1

Fig. 1

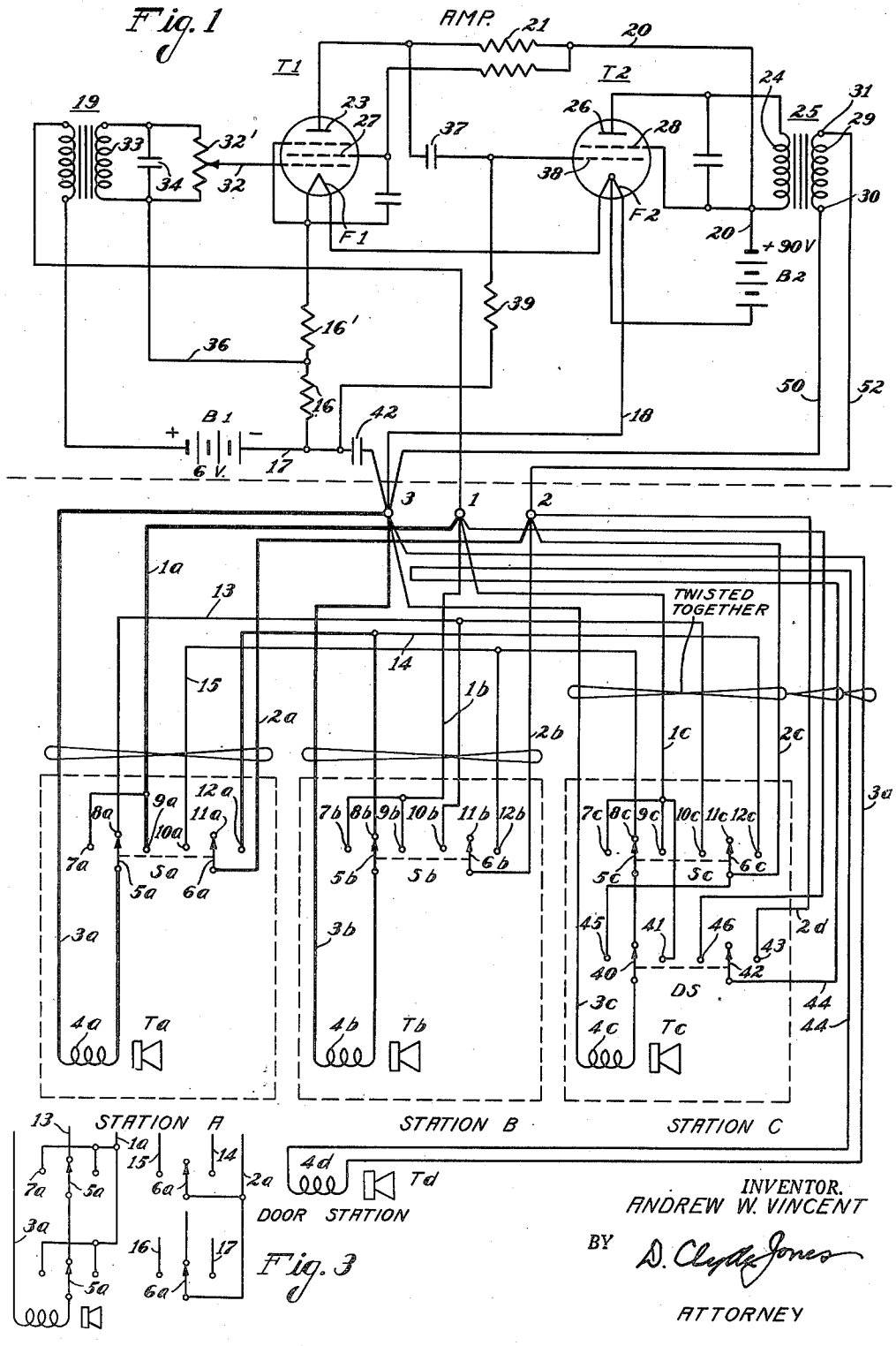


Fig. 3

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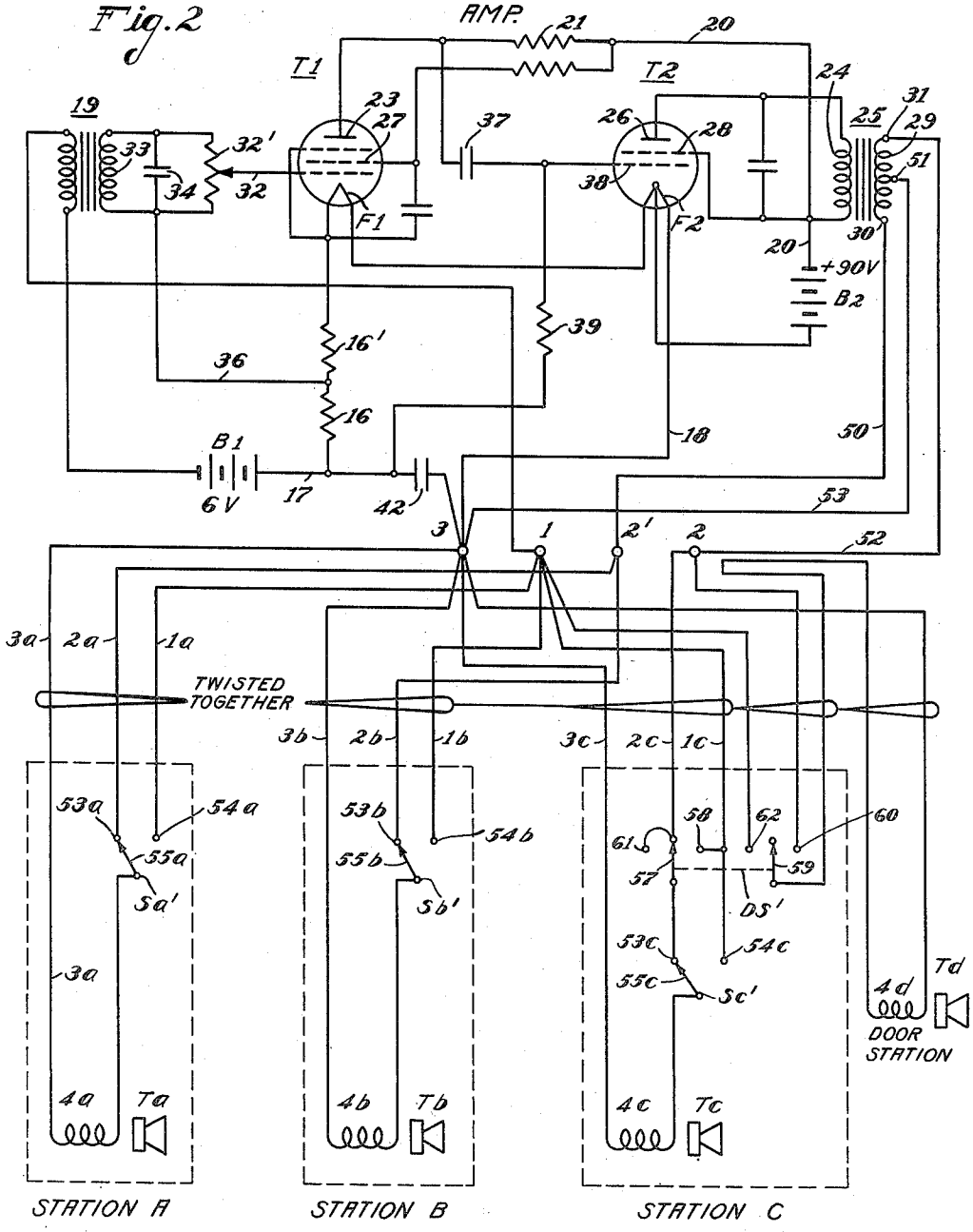
ATTORNEY

Sept. 26, 1950 A. W. VINCENT 2,523,671

INTERCOMMUNICATING SYSTEM

Filed Jan. 25, 1949 2 Sheets-Sheet 2

Fig. 2



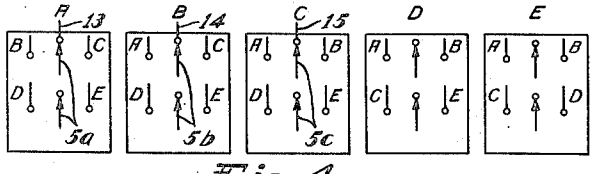


Fig. 4

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Patented Sept. 26, 1950

2,523,671

UNITED STATES PATENT OFFICE

2,523,671

INTERCOMMUNICATING SYSTEM

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Application January 25, 1949, Serial No. 72,692

8 Claims. (Cl. 179—1)

1

This invention relates to intercommunicating telephone systems.

In applicant's copending application Serial No. 707,867, filed November 5, 1946, now Patent No. 2,493,174, dated Jan. 3, 1950, there is disclosed an intercommunicating telephone system using a transducer at each station for talking as well as for listening by means of an amplifier to which the several stations are connected in common.

The present invention has for its purpose the improvement of the intercommunicating system disclosed in the mentioned application whereby selective intercommunication can be effected between two stations of the system, and yet the improved system is simple to manufacture and is easy to install by workmen of limited skill.

A further purpose of the present invention is to provide a selective or non-selective intercommunicating telephone system in which a given station or stations therein can converse with a door station when a doorbell is rung from the last-mentioned station.

The various features and advantages of the system will appear from the detailed description and claims when taken with the drawing in which:

Fig. 1 is a circuit diagram of a selective intercommunicating system having a door answering arrangement incorporated therein; and

Fig. 2 is a circuit diagram of a non-selective intercommunicating system also provided with a door answering arrangement. Figs. 3 and 4 show parts of a modified system.

In the preferred form of the invention, there are provided a plurality of intercommunicating stations A, B, C, station C being provided with the door answering arrangement to be described. These stations are linked in multiple to the input terminal 1, the output terminal 2 and the "common" terminal 3 of the amplifier AMP, by the input wires 1*a*, 1*b*, and 1*c*, as well as by the output wires 2*a*, 2*b*, and 2*c* and by the "common" wires 3*a*, 3*b*, and 3*c*. At each of the respective stations, there is located a two-way transducer such as T*a*, T*b*, and T*c* in the form of a moving coil or dynamic loud speaker of the permanent magnet type, the moving coils thereof being designated 4*a*, 4*b*, and 4*c*, respectively. At the several stations there are also provided selectively operable manual switches S*a*, S*b*, and S*c*. Each switch, for example S*a*, comprises two manually movable contacts such as 5*a* and 6*a* insulated from each other but movable as a unit. These contacts are respectively movable into engagement with two sets of fixed contacts 7*a*, 8*a*, and 9*a*, and 10*a*, 11*a*, and 12*a*. Normally the movable contact 5*a* automatically returns into engagement with fixed contact 8*a* while movable contact 6*a* automatically returns into engagement with fixed contact 11*a*. It will be understood that there is a fixed contact in each set for each station in the system. The switches S*b*, and S*c*, at the remaining stations are identical in construction with the switch just described.

2

In accordance with the one feature of the invention, at least one of the stations, such as station C, is also provided with an arrangement whereby it can also be connected to a door station to enable conversation to be held with a person who has rung the doorbell at the door station. To this end the station C is also provided with a door switch DS whereby station C can be connected through the amplifier AMP to the transducer T*d* at the door station.

The moving coil, such as 4*a* of the transducer T*a* has one of its terminals connected to the common conductor 3*a* while its other terminal is connected to the movable contact 5*a* of the manual switch S*a*. The other moving coils 4*b*, and 4*c*, of the transducers T*b*, T*c*, are similarly connected except that at station C the door switch DS is introduced between the transducer T*c* and the switch S*c*.

It will be noted that the input conductor 1*a* is connected in multiple to the fixed contacts 7*a* and 9*a* but is not connected to fixed contact 8*a* with which the movable contact 5*a* is normally in engagement. The input conductors 1*b*, and 1*c*, are similarly connected at their respective stations B, and C. The output conductor such as 2*a* is connected to the movable contact 6*a* at its related station where this contact normally engages the fixed contact 11*a*. This last-named contact has no conductor connected thereto. Output conductors 2*b*, and 2*c*, are respectively connected to the movable contacts 6*b*, and 6*c*. These contacts respectively normally engage the fixed contacts 11*b*, 11*c*, these fixed contacts likewise having no conductors connected thereto.

The stations A, B, C, are also connected by the link conductors 13, 14 and 15, it being understood that a link conductor is provided for each additional station. The link conductor 13 has a branch extending to each station, the branch leading to station A terminates at contact 8*a* while the branch leading to station B terminates in contact 10*b* and another branch thereof leads to station C where it terminates at contact 10*c*.

A branch of link 14 terminates at station A in contact 12*a*, while another branch thereof terminates at station B in a contact 8*b* and a further branch thereof terminates at station C in a contact 12*c*.

The link 15 has a branch terminating at station A in contact 10*a*, while another branch thereof terminates in contact 12*b* at station B and a further branch thereof terminates in contact 8*c* at station C.

The amplifier AMP is preferably of the multistage capacity-coupled type and uses quick heating vacuum tubes energized from batteries such as are used for the filament supply and plate supply in portable radio receivers. In the preferred form of the invention, the amplifier comprises a pentode tube T1 (preferably of the type now known as 1LN5) and also comprises the beam power tube T2 (of the type now known as 3LF4). Each station can selectively connect with any one of the remaining stations. For example, if station A wishes to talk to station B, the switch S*a* must be adjusted to position movable contact 5*a* into engagement with contact 9*a* and to position movable contact 6*a* into engagement with fixed contact 12*a* which is normally connected to coil 4*b* of transducer T*b*. It will be noted that no circuit is closed at this time to the moving coil 4*c* of transducer T*c* at station C so that this station can not engage in conversation. When manual switch S*a* is operated as just described, the coil 4*a* of the transducer T*a* at station A is connected by the input transformer 19 to the input of the amplifier AMP while station B is selectively connected to the output of the amplifier by the output transformer 25. The closure of the manual switch S*a* at the station A, as just described, completes a direct current circuit for heating the filaments F1 and F2 of vacuum tubes T1, and T2. This circuit can be traced from the negative pole of battery B1, conductor 17, resistor sections 16 and 16′, through filaments F1 and F2 in series, conductor 18, common conductor 3*a*, the coil 4*a* of transducer T*a*, movable contact 5*a*, now in engagement with contact 9*a*, input conductor 1*a*, thence through the primary winding of the input transformer 19, to the positive pole of battery B1. The plate battery B2 has its negative pole connected to the center tap of filament F2 and through conductor 18 to terminal 3 from which the common conductors 3*a*, 3*b* and 3*c* branch.

Since the tube T2 is of the filament type, changes in plate current cause changes in the filament current because the plate current must enter the filament connections and travel along the filament until the electrons are drawn off into space by the plate. The audio component of the plate current produced across the filament F2 when the negative terminal of the plate battery is connected to either end of the filament, causes an audio voltage in the filament circuit which is introduced into the input circuit through the effective series resistance of the shunt capacitor 42 and causes undesirable regeneration or degeneration in the amplifier depending upon which side of the filament the negative battery connection is made. By connecting the negative of the plate battery B2 to the center of the filament F2, the plate current flows out into both halves of this filament before being emitted, thereby producing two audio voltages in the same series circuit which are equal and opposite in direction and therefore cancel with a sufficiently diminished effect upon the input circuit as to maintain amplifier stability.

The positive pole of battery B2 is connected by conductor 20 through the resistor 21 to the anode 23 of tube T1 and through the primary winding 24 of the output transformer 25 to the anode 26 of the tube T2. The screen grid 27 and suppressor grid 28 of tubes T1 and T2 respectively are maintained at the proper operating voltage from battery B2 in the well known manner. The input circuit of the tube T1 includes the grid 32 of this tube, a volume control unit 32′ in the form of a voltage divider connected across the terminals of secondary winding 33 of the input transformer and the condenser 34 connected across the terminals thereof, conductor 36, resistor 16′, to the filament F1.

The condenser 37 couples the output of tube T1 to the input circuit of tube T2, which circuit includes the grid 38. A high capacity low voltage capacitor 42 (100 mfd.) is connected across the series connected tube filaments F1 and F2 and the resistances 16 and 16′ so that the talking voltage generated at the speaker station will not appear across the tube filaments, which have a high impedance relative to the speaker voice coil impedance, but will be shunted by the capacitor 42 and will be applied across the low impedance amplifier input.

The low impedance secondary winding 29 of the output transformer has its terminal 30 connected to the "common" terminal 3 and has its terminal 31 connected to the output terminal 2. The "common" terminal 3 and the output terminal 2 are connected in a circuit including the transducer coil 4*b* at the station B which was selected by the party at station A when he adjusted the switch S*a* in the manner already described. This circuit may be traced from terminal 3, conductor 3*b*, transducer coil 4*b*, link 14, contact 12*a*, movable contact 6*a*, conductor 2*a* to terminal 2.

When the person at station B is to reply to station A, the switch S*a* is released whereby its movable contact 5*a* engages fixed contact 8*a* leading to conductor 13, and its movable contact 6*a* engages the blank contact 11*a*. These operations disconnect station A from the input of the amplifier and reconnect that station to the link conductor 13. The switch S*b* at station B is moved to the left so that movable contact 5*b* engages contact 7*b* and movable contact 6*b* engages 10*b*. In this way station B is connected to the input of the amplifier and station A is connected through link conductor 13 and movable contact 6*b*, to the output of the amplifier. By the alternate operations of the switch S*a* and S*b*, the parties at the stations A and B can alternately talk and listen.

In the event that station A desires to talk to station C, switch S*a* is now moved to the left to connect the transducer T*a* to the input of the amplifier. Station C is connected to the output of the amplifier in the same manner as when station B was called since switch DS is now in the position illustrated.

In the event that the doorbell (not shown) is rung from the door station, the person at station C can talk with the party who rang the doorbell. This is effected by moving the movable contact 40 of switch DS to the right until it engages the contact 41 which is connected to the conductor 1*c*. This connects the transducer T*c* at station C to the input of the amplifier. Also when switch

DS is moved to the right the movable contact 42 of this switch engages contact 43 which is connected to conductor 2d leading to the output terminal 2 of the amplifier. The movable contact 42 of the door switch is connected by conductor 44 to one end of the transducer coil 4d, the other end of which is connected by conductor 3d to the common terminal 3 of the amplifier. Thus the transducer Td is connected across the output of the amplifier. Station C can now talk to the party at the door station. When station C desires to listen to the party at the door station, the switch DS is moved to the left, to bring the movable contacts 40 and 42 into engagement with the contacts 45 and 46 respectively. This operation connects the transducer Td to the input of the amplified and the transducer Tc to the output of the amplifier.

It will be noted that the input conductors of an originating station (which, of course, can be any of the stations) as well as the output conductors thereof extend to the station and back to the amplifier through two closed loops, the speaker lead being in series with the input loop. Since the output circuit or loop is of higher power than the input circuit or loop, inductive coupling is set up to the input loop with the resultant feedback action. In the circuit diagram of Fig. 1, the input circuit of calling station A is drawn in much heavier lines than the remainder of the diagram and the output circuit is drawn in slightly heavier lines since it is assumed that the telephone connection is being made from station A to station B. From this it will be seen that there are two current loops in the originating station A and a single current loop at the called station B. It will be appreciated that the two loops in the calling station tend to cause feed-back difficulty. In order to avoid this difficulty, coupling must be reduced to a low degree by separating into groups the triple wires of each of the two mentioned loops and then twisting together the wires of a group. In this grouping the common wire, the speaker wire and the input wire are in one group and the output wire and link wires are arranged in another group. By this arrangement, the stations such as A, B, and C, can be located as far as five hundred feet from the amplifier with the insulation of the wires of the two twisted groups touching each other. If it is desired to have the amplifier at a distance greater than five hundred feet from the stations, the groups of twisted wires are separated a distance apart. It should be pointed out that the common circuit must be extended individually to the common terminal 3 of the amplifier since input and output current is carried by each common conductor. Also it is necessary to bring all leads or conductors back to a common point near the amplifier since the elimination of an output lead or an input lead in the twisted groups would destroy the balance.

The doorbell answering arrangement just described can also be incorporated in a non-selective intercommunicating telephone system as disclosed in Fig. 2. In this form of the invention, the amplifier is arranged in the same manner as that shown in Fig. 1 but differs therefrom in that it has a divided output represented by the output terminals 2' and 2 for the purpose of neutralizing capacitive coupling as will be described. Terminal 2' is connected by conductor 50 to the terminal 30 of the output transformer winding 29 while output terminal 2 is connected by the conductor 52 to the terminal 31 of the output transformer winding 29. The intermediate point 51 of winding 29 is connected by conductor 53 to the common terminal 3 of the amplifier. Except for these mentioned differences, corresponding elements of the amplifiers shown in Figs 1 and 2 are designated by the same reference characters.

It will be noted that the selective link conductors 13, 14 and 15 of the system of Fig. 1 are not necessary in the non-selective system shown in Fig. 2 and have, therefore, been omitted.

The stations A, B, and C in the non-selective system are provided with switches Sa', Sb' and Sc' respectively. Each of these switches includes an output or "listen" contact such as 53a and an input or "talk" contact such as 54a as well as a movable contact 55a which normally returns into engagement with contact 53a for listening, when released, but can be moved to engage contact 54a when the party at station A wishes to talk. Station C, which is equipped with the door answering arrangement, is provided with a door switch DS'. The construction and operation of this door switch is simliar to that of door switch DS in the selective system of Fig. 1.

In the system disclosed in Fig. 2, when a station such as station A desires to talk with the stations B and C the switch Sa' is held at the "talk" position. This advances the switch blade 55a into engagement with the contact 54a. Station A is now connected to the input of the amplifier while stations B and C are connected to the output thereof so that the person at that station A can talk with a person at the distant stations B or C or with persons at stations B and C when the person at a distant station holds the switch thereat in the "talk" position while the person at station A releases his switch to the "listen" position, the person at the distant station can reply. By proper manipulation of the switches at the respective stations, intercommunications can be effected between them.

In the event that the doorbell (not shown) is rung from the door station, it will be heard at station C. The person at station C will operate to the right, the door switch DS' at his station. This will simultaneously swing switch blade 57 into engagement with the input contact 58 of the amplifier and switch blade 59 into engagement with the output contact 60 of the amplifier. The person at station C can now talk with the party at the door station. When the person at station C wishes a reply from that party the door switch DS' is operated toward the left. This brings the switch blade 57 into engagement with the amplifier output contact 61 and the switch blade 59 into engagement with the amplifier input contact 62. Station C can now listen to the party at the door station. By proper manipulation of the door switch DS' intercommunication between station C and the door station can be carried on.

It will be noted that wires 2a and 2b are connected to the output terminal 2' of the amplifier while conductor 2c is connected to the amplifier output terminal 2 to effect electrical balance at the amplifier necessitated by the different lengths of these wires. For example, if wire 2c is four hundred feet long, it can be balanced by the combined lengths of wires 2a and 2b, each of which is assumed to be two hundred feet long.

The system disclosed in Fig. 1 is arranged for communication between three stations A, B, and C. If the system is enlarged to effect communication between five stations A, B, C, D and E the switching means at each station will be dupli-

cated in the manner indicated in Fig. 3. Also a link will be provided for each station that is added. The link of each station such as link 13 of station A is connected to contact 8 of its related switch while this link terminates at the contacts A at each of the four other stations in accordance with the pattern indicated in Fig. 4. The remaining links for stations B, C, D and E will be connected in a similar manner and will terminate at the contacts designated by their respective station letters at each of the other stations as indicated in Fig. 4.

In operating this enlarged system, the party originating a call, will select the upper or lower of his switching units through which a wanted station can be reached. The selected switching unit is then operated to the right or left as the case may be to effect a connection to a wanted station through the link thereof.

It will be understood that the system can be further enlarged by the provision of additional switching units at each of the stations and by the provision of a link for each station added. The connection of the several links will be similar to that indicated in Fig. 4.

What I claim is:

1. In an intercommunicating telephone system, a plurality of stations, a link individual to each station and having branches terminating at the remaining stations, a transducer at each station serving both as a microphone and as a receiver, an amplifier common to said stations, selectively operable switching means at each station comprising primary and secondary sets of inactive contacts and a primary active contact cooperating with said primary set and a secondary active contact cooperating with said secondary set, each active contact being movable into engagement with the inactive contacts of its set, the primary active contact at each station being normally in engagement with one of its inactive contacts at its station, said amplifier being provided with an input terminal, an output terminal and a common terminal, means connecting the primary active contact at each station in series with the transducer at its station to said common terminal, means for connecting a plurality of the remainder of said primary inactive contacts at each station being connected to said input terminal, a branch of the link conductor individual to a given station terminating in the primary inactive contact with which its primary active contact is normally in engagement at said given station, means connecting the secondary active contact at the given station to said output terminal, a branch of each of the remaining links terminating in an individual inactive secondary contact at the given station.

2. In an intercommunicating telephone system, a plurality of stations, a link individual to each station and having branches terminating at the remaining stations, a transducer at each station serving both as a microphone and as a receiver, an amplifier common to said stations, selectively operable switching means at each station comprising primary and secondary sets of inactive contacts and a primary active contact cooperating with said primary set and a secondary active contact cooperating with said secondary set, each active contact being movable into engagement with the inactive contacts of its set, the primary active contact at each station being normally in engagement with one of its inactive contacts at its station, said amplifier being provided with an input terminal, an output terminal and a common terminal, means for connecting the primary active contact at each station in series with the transducer at its station to said common terminal, means for connecting a plurality of the remainder of said primary inactive contacts at each station to said input terminal, a branch of the link conductor individual to a given station terminating in the primary inactive contact with which said primary active contact is normally in engagement at said given station, means for connecting active contact at the given station to said output terminal, a branch of a link individual to a given station terminating in a secondary inactive contact at each of the remaining stations, said last-mentioned inactive contacts being arranged in different permutations with respect to their respective cooperating secondary active contacts.

3. In an intercommunicating telephone system, a plurality of stations, a link individual to each station and having branches terminating at the remaining stations, a transducer at each station serving both as a microphone and as a receiver, an amplifier common to said stations, selectively operable switching means at each station comprising primary and secondary sets of inactive contacts and a primary active contact cooperating with said primary set and a secondary active contact cooperating with said secondary set, each active contact being movable into engagement with the inactive contacts of its set, means for simultaneously moving the primary and secondary active contacts at each station, the primary active contact at each station being normally in engagement with one of its inactive contacts at its station, said amplifier being provided with an input terminal, an output terminal and a common terminal, means for connecting the primary active contact at each station in series with the transducer at its station to said common terminal, means for connecting a plurality of the remainder of said primary inactive contacts at each station to said input terminal, a branch of the link conductor individual to a given station terminating in the primary inactive contact with which said primary active contact is normally in engagement at said given station, means for connecting the secondary active contact at the given station to said output terminal, a branch of each of the remaining links terminating in an individual inactive secondary contact at the given station.

4. In an intercommunicating telephone system, a plurality of stations, a link individual to each station and having branches terminating at the remaining stations, a transducer at each station serving both as a microphone and as a receiver, an amplifier common to said stations, selectively operable switching means at each station comprising duplicate primary and duplicate secondary sets of inactive contacts and a primary active contact cooperating with each set of said primary inactive contacts and a secondary active contact cooperating with each set of said secondary inactive contacts, each active contact being movable into engagement with inactive contacts of its set, the primary active contacts at each station being normally in engagement with one of their inactive contacts at their station, said amplifier being provided with an input terminal, an output terminal and a common terminal, means for normally connecting the primary active contacts at each station in series with the transducer at their station to said common terminal, means for connecting a

plurality of the remainder of said primary inactive contacts at each station to said input terminal, means for connecting the link conductor individual to a given station to the primary inactive contacts with which said primary active contacts are normally in engagement at said given station, means for connecting the secondary active contacts at the given station to said output terminal, a branch of each of the remaining links terminating in an individual inactive secondary contact at the given station, said branches at the several stations terminating in said secondary inactive contacts in accordance with different permutations whereby selective telephone interconnections of said stations can be effected.

5. In an intercommunicating telephone system, a plurality of stations, a link individual to each station and having branches terminating at the remaining stations, a transducer at each station serving both as a microphone and as a receiver, an amplifier common to said stations, selectively operable switching means at each station comprising primary and secondary sets of inactive contacts and a primary active contact cooperating with said primary set and a secondary active contact cooperating with said secondary set, each active contact being movable into engagement with the inactive contacts of its set, the primary active contact at each station being normally in engagement with one of its inactive contacts at its station, said amplifier being provided with an input terminal, an output terminal and a common terminal, means for connecting the primary active contact at each station in series with the transducer at its station to said common terminal, means for connecting a plurality of the remainder of said primary inactive contacts at each station to said input terminal, the link conductor individual to a given station terminating in the primary inactive contact with which said primary active contact is normally in engagement at said given station, means for connecting the secondary active contact at the given station to said output terminal, a branch of a link individual to a given station terminating in a secondary inactive contact at each of the remaining stations, said last-mentioned inactive contacts at the several remaining stations being arranged in different permutations with respect to their respective cooperating secondary active contacts, a substation including a transducer located at a remote point, and means including supplemental switching means at one of said stations for connecting the transducer thereat to the input portion of the amplifier and the substation transducer to the output portion of the amplifier and vice versa whereby conversation can be conducted through the last-mentioned transducers.

6. In an intercommunicating telephone system, a plurality of stations, a link conductor individual to each station and having branches terminating at the remaining stations, a transducer at each station serving both as a microphone and as a receiver, an amplifier common to said stations, selectively operable switching means at each station comprising primary and secondary sets of inactive contacts and a primary active contact cooperating with said primary set and a secondary active contact cooperating with said secondary set, each active contact being selectively movable into engagement with the inactive contacts of its set, the primary active contact at each station being normally in engagement with one of its inactive contacts at its station, such amplifier being provided with an input terminal, an output terminal and a common terminal, means including a conductor connecting the primary active contact at each station in series with the transducer at its station to said common terminal, an input conductor connecting a plurality of the remainder of said primary inactive contacts at each station to said input terminal, the link conductor individual to a given station terminating in the primary inactive contact with which said primary active contact is normally in engagement at said given station, an output conductor connecting the secondary active contact at the given station to said output terminal, said last-mentioned inactive contacts at the several stations being arranged in different permutations with respect to their respective cooperating secondary active contacts, and means for reducing electrical coupling between a group of said electrical conductors including an input conductor and a group of conductors including an output conductor.

7. In an intercommunicating telephone system, a plurality of stations each provided with a transducer for transmitting and for receiving signals, an electronic audio amplifier having an input portion and an output portion, each station having an input conductor coupled to the input portion of the amplifier as well as an output conductor coupled to the output portion of said amplifier and a common conductor connected to said amplifier, means including a manual switch at each station normally connecting the transducer thereat in circuit with the output conductor and with the common conductor thereof in readiness for the reception of signals from said amplifier, the switch at each station being operable at will to connect the transducer thereat in circuit with the input conductor and with the common conductor thereof for the transmission of signals from the station to each of the other stations while the switch is operated, a substation including a transducer located at a remote point, and means including supplemental switching means at one of said stations for connecting the transducer thereat to the input portion of the amplifier and the substation transducer to the output portion of the amplifier and vice versa whereby conversation can be conducted through the last-mentioned transducers.

8. In an intercommunicating telephone system, a plurality of stations each provided with a transducer for transmitting and receiving signals, an audio amplifier having an input portion and an output portion, said amplifier including at least one electron tube provided with a filamentary cathode, a source of direct current, each station having an input conductor coupled to the input portion of the amplifier as well as an output conductor coupled to the output portion of said amplifier and a common conductor connected to said amplifier, means including a manual switch at each station normally connecting the transducer thereat in circuit with the output conductor and with the common conductor thereof in readiness for the reception of signals from said amplifier, the switch at each station being operable at will to connect the transducer thereat in circuit with the input conductor and with the common conductor thereof for the transmission of signals from the station with the operated switch, a circuit completed by said last-mentioned switch and including in series said cathode, said source of

direct current together with said last-mentioned input and common conductors, a substation including a transducer located at a remote point, and means including supplemental switching means at one of said stations for connecting the transducer thereat to the input portion of the amplifier and the substation transducer to the output portion of the amplifier and vice versa whereby conversation can be conducted through the last-mentioned transducers.

ANDREW W. VINCENT.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,162,369	Campbell	June 13, 1939
2,249,456	Campbell	July 15, 1941

Certificate of Correction

Patent No. 2,523,671 September 26, 1950

ANDREW W. VINCENT

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 8, line 11, after the word "connecting" insert *the secondary*; column 10, line 2, for "such" read *said*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of November, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.