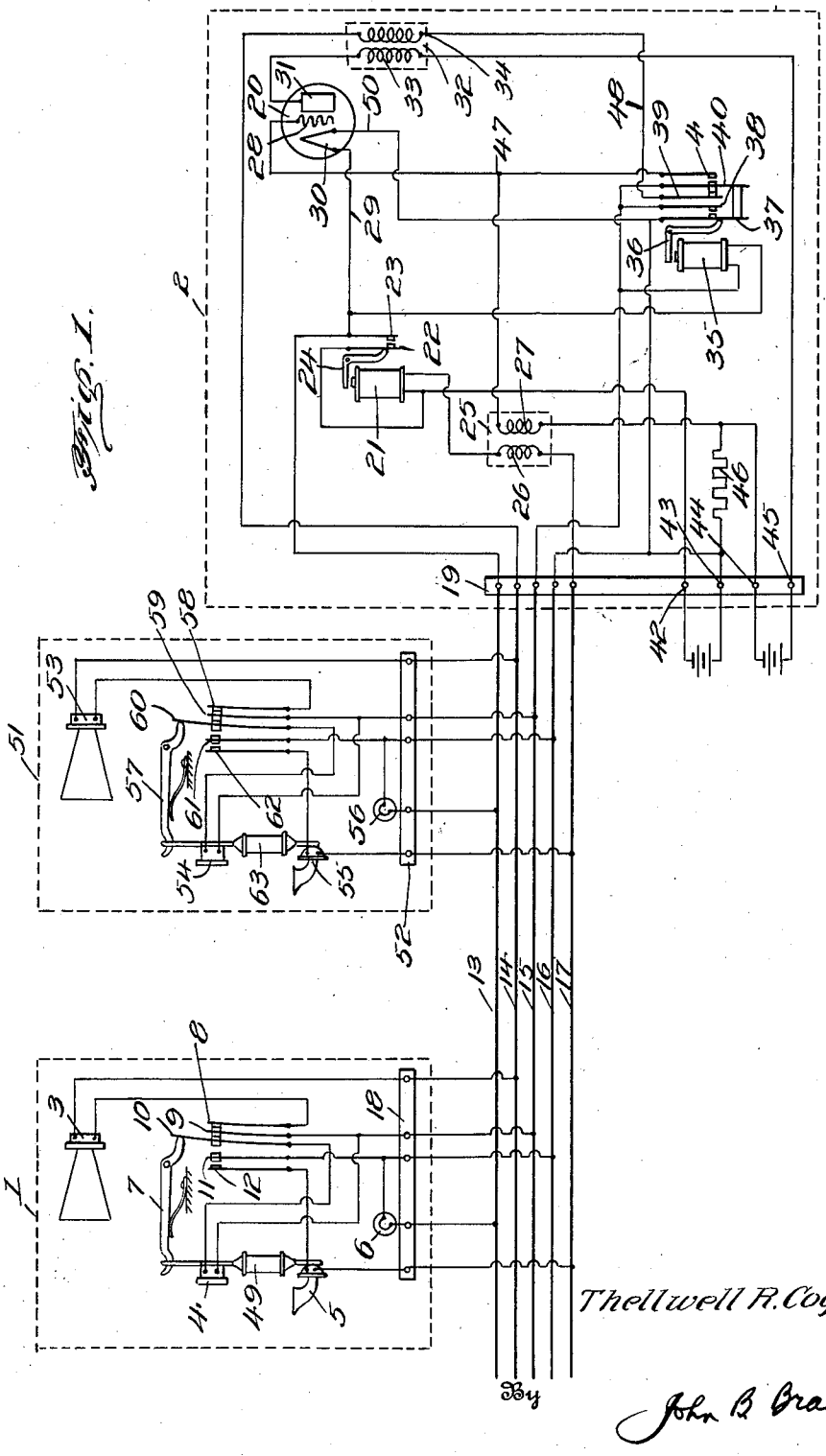
Nov. 1, 1927. 1,647,606

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INTERCOMMUNICATION SYSTEM

Filed Nov. 28, 1925 2 Sheets-Sheet 1



Inventor

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INTERCOMMUNICATION SYSTEM

Filed Nov. 28, 1925 2 Sheets-Sheet 2

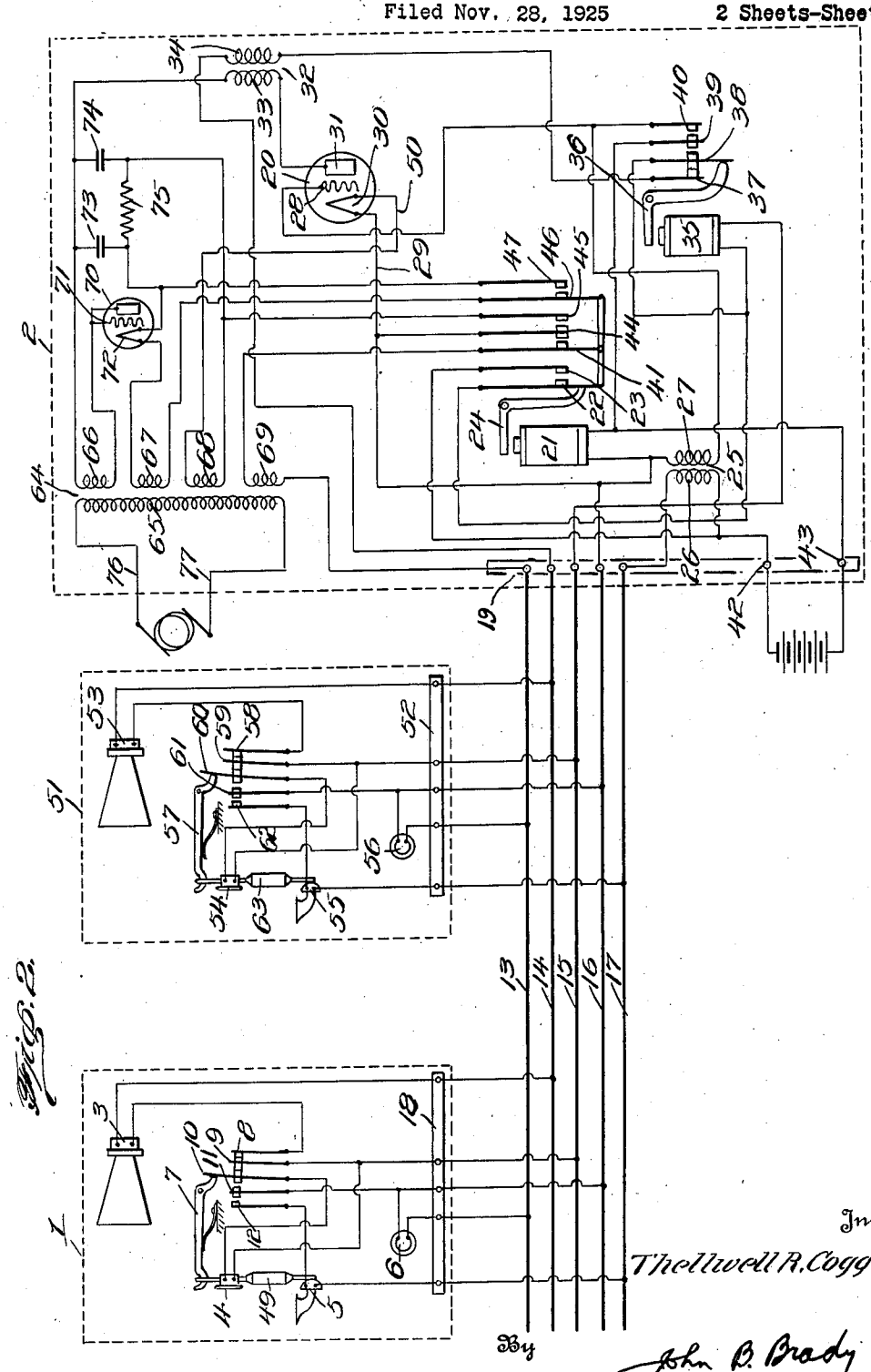


Fig. 2.

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UNITED STATES PATENT OFFICE.

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INTERCOMMUNICATION SYSTEM.

Application filed November 28, 1925. Serial No. 71,893.

My invention relates broadly to telephone systems and more particularly to an intercommunication system between various points of a business and factory organization.

One of the objects of my invention is to provide a loud speaking intercommunication telephone system by which a desired individual may be reached at various points in a large organization and placed in communication with the caller without delay.

Another object of my invention is to provide a plurality of loud speaker stations situated at different points in a business organization which may be actuated simultaneously by a calling party from a single station for broadcasting a call for a particular individual or transmitting an order simultaneously to the several stations whereby the desired individual may answer back from any one of the several stations and be placed in instant communication with the calling party to the exclusion of all of the other stations.

Still another object of my invention is to provide an intercommunication telephone system in which a plurality of loud speakers distributed at various stations throughout a business organization may be controlled from any one station for locating a desired individual with means at each station whereby the party called may answer back from any desired station automatically securing private direct communication with the calling party and at the same time rendering all loud speakers inoperative and actuating a busy signal and a lock at each of the other stations for insuring privacy of the conversation.

A further object of my invention is to provide an intercommunication telephone system for factory and business service in which a central station provided with amplifying and switching equipment is arranged to control the operation of any number of outlying loud speaker, transmitter and receiving stations, whereby loud speaker voice signals may be broadcasted through the several stations for locating a desired individual with means at each station where the desired individual may answer back and automatically disconnect all loud speakers and secure private and uninterrupted communication with the calling party.

A still further object of my invention is to provide a system of telephone intercommunication including electron tube amplification and switching means which may be installed with minimum expense and operated from energy supplied from the usual lighting circuit without the necessity of employing primary or secondary batteries.

My invention will be more fully understood from the following specification by reference to the accompanying drawings, wherein:—

Figure 1 illustrates diagrammatically the telephone intercommunication system of my invention showing two loud speaker transmitter and receiver stations arranged for operation with a central control station; and Fig. 2 shows the intercommunication telephone system having switching and electron tube amplifying apparatus at a central station which is energized from the usual lighting circuit without the employment of primary and secondary batteries.

Referring to the drawings in detail, reference characters 1 and 51 show the wiring diagram of loud speaker transmitter and receiver stations. Reference character 2 indicates the wiring arrangement of the control box. Considering loud speaker station 1, reference numeral 3 indicates the loud speaker, 7 is the switch hook, 49 the telephone hand set, 6 the busy signal and 18 is the terminal block. Considering loud speaker station 51, which is identical to station 1, 52 is a terminal block, 53 a loud speaker, 63 is a telephone hand set with transmitter 55, and receiver 54, 56 is a busy signal and 57 is a switch hook. These stations are connected to control box 2 by means of wires 13, 14, 15, 16 and 17.

Considering the control station 2, 19 is the terminal block, 21 is a current relay, 35 is the relay to disconnect the loud speakers and connect the telephones in circuit, 25 is a transformer with primary winding 26 and secondary 27, 46 is noninductive resistance

connected in series with wires 43 and 44 so as to prevent a short circuit on the secondary 27 of the transformer 25 when the telephones are connected in circuit. Reference character 32 indicates a transformer with primary winding 33 and secondary 34. Reference character 20 represents an electron tube. Wires 42 and 43 connect to a source of energy for filament 30, busy indicator 6, transmitter 5 and relays 21 and 35. Wires 44 and 45 connect to a source of energy for plate circuit of electron tube 20 between filament 30 and plate electrode 31.

In Fig. 1 I have shown the wiring arranged so that the system can be operated by any source of direct current such as batteries, motor generator, or house current. If batteries are used they are connected direct to terminals 42, 43, 44 and 45. If a motor generator is used it can be allowed to run at all times leaving current relay 21 to open and close the current from the generator or the motor can be controlled direct by relay 21 or an auxiliary relay so that it will only run when a phone receiver is removed from its switch hook. If house current is used it can be connected to terminals 44 and 45 through a resistance or potentiometer to terminals 42 and 43. While I have illustrated only two loud speaker transmitter and receiver stations it will be understood that any number of these units may be distributed throughout various points in a business organization and actuated from the central station.

The operation of the system will be understood by a consideration of the following sequence of events:

When hand set 49 at loud speaker station 1 is removed from switch hook 7, a circuit is completed from positive terminal 43 in control station 2, through wire 16, spring 11 at station 1, spring 12, transmitter 5, wire 17, primary 26 of transformer 25 in control 2, relay 21 to negative terminal 42. This causes current to flow through the transmitter circuit and also operates relay 21 pulling down armature 24, closing springs 22 and 23 which closes the following circuits; first from negative terminal 42 to spring 22 of relay 21, spring 23, wire 29, filament 30, wire 50, to positive terminal 43, thus causing filament 30 to be heated; second from negative terminal 42, springs 23 and 22 of relay 21, wire 13 to busy signal 6 of station 1 and busy signal 56 of station 51, and wire 16 to positive terminal 43 of control 2. This causes busy signals in all stations to operate.

The circuit is now ready for use. If transmitter 5 of station 1 is spoken into a varying current is set up in primary 26 of transformer 25. This current is induced in secondary 27 causing a varying potential to be imposed on the grid 28 of the electron tube 20 which in turn changes the impedance of the plate circuit between the electrodes 30 and 31 causing a varying current to flow in primary 33 of transformer 32 which is induced in secondary 34. This current is transmitted to loud speaker 53 as follows: from secondary 34 of transformer 32, to wire 14, to loud speaker 53 of station 51, to springs 58 and 59 of hook switch 57, to wire 15, then along wire 15 to springs 40 and 39 of relay 35, wire 48, back to secondary 34. This causes all loud speakers to operate.

As soon as a person called is located he goes to the nearest station and removes the telephone set from the switch hook which changes the circuit as follows: If telephone hand set 63 at station 51 is removed from the switch hook 57, springs 59, 60 and 61 make temporarily as main spring 60 goes up, the circuit at this point is as follows: from negative terminal 42, springs 23 and 22 of relay 21, to relay coil 35, wire 15, springs 59, 60 and 61, wire 16, to positive terminal 43. This causes relay 35 to operate pulling down armature 36 momentarily, but springs 37 and 38 are brought in contact causing current to flow from negative terminal 42, springs 22 and 23 of relay 21, to relay coil 35, springs 38 and 37 to positive terminal 43, thus supplying current to hold down relay 35 as long as relay 21 is held down. This disconnects wire 15 from secondary 34 of transformer 32 when spring 40 is separated from spring 39 and connects wire 15 to secondary 27 of transformer 25 thus disconnecting all loud speakers. Varying current then flows from secondary 27 of transformer 25 through wire 47, springs 41 and 40 of relay 35, wire 15 to receiver 4 at station 1 to springs 10 and 11, wire 16 also from wire 15 to receiver 54 at station 51 to springs 60 and 61, to wire 16. From wire 16 the circuit is completed through resistance 46 to secondary winding 27. This causes a varying current to operate the phone receivers and conversation is thus possible between telephone sets. If the hand sets are not off the switch hook at the other stations current is prevented from operating them as springs 10 and 11 are broken.

When conversation is completed both parties hang the telephone set up, this breaks springs 10, 11 and 12 at the stations, thus opening the circuit holding down relay 21, which is then released. Springs 22 and 23 are thus broken, opening up the circuit holding down relay 35 and releasing this relay. No current is therefore flowing in any circuit and the system is restored to normal ready to receive another call.

In Fig. 2 of the drawings, the arrangement of the central station is shown for operation of the switching and electron tube amplifying system from the usual alternating current lighting circuit. Considering the control box 2, 19 is the terminal

block, 21 is the power relay, 35 the relay to disconnect the loud speakers and connect the telephone set in circuit, 25 is a transformer with primary winding 26 and secondary 27, 32 is a transformer with primary winding 33 and secondary 34, 20 is an electron tube to amplify the audio frequency voice currents, 70 is an electron tube arranged to rectify the A. C. electric light current, 64 is a power transformer with primary 65 connecting to a source of A. C. current and four secondaries 66, 67, 68 and 69. Secondary 66 supplies a current for the plate circuit of amplifying tube 20, 67 supplies the current for the filament of the rectifying tube, 68 supplies the current for the filament of the amplifying tube, and 69 supplies the current for operating the busy signals. 73 and 74 are condensers and 75 is a choke coil for smoothing the ripples in the rectified A. C. current, 42 and 43 are terminals to connect to a source of direct current to supply energy for the transmitter circuit.

In the wiring diagram of the control box in Fig. 2 it will be observed that the entire system will operate on alternating current for all parts of the circuit except the transmitter circuit which can be supplied with current from dry cells or storage batteries across terminals 42 and 43. The primary winding of transformer 64 can be either left in circuit at all times or be controlled by relay 21.

The operation of the system is as follows: When hand set 49 at loud speaker station 1 is removed from switch hook 7 current flows from battery to positive terminal 43, relay 21, wire 16, springs 11 and 12 of switch hook 7, transmitter 5, wire 17, primary 26 of transformer 25 to negative battery terminal 42. This energizes the coil of relay 21 pulling down armature 24 closing the following circuits:—

(1) From secondary 69 of transformer 64, wire 13, busy signal 6 and 56, wire 16, springs 44 and 41 of relay 21 back to the other side of secondary 69. This causes the busy signal to operate at all loud speaker stations.

(2) From secondary 68 of transformer 64, filament 30 of electron tube 20, springs 44 and 45 of relay 21, to the other side of secondary 68. This causes the filament of tube 20 to light.

(3) From secondary 67 of transformer 64, filament 72 of electron tube 70, springs 47 and 46 of relay 21 back to the other side of secondary 67. This causes filament 72 of tube 70 to light.

(4) From secondary 66 of transformer 64, grid and plate 71 of electron tube 70 past condenser 73, through choke coil 75 past condenser 74, springs 45 and 44, relay 21, filament 30 of electron tube 20, plate 31 of electron tube 20, primary 33 of transformer 32, past condenser 74 and 75 to the other side of secondary 66 of transformer 64. This supplies a rectified current for the plate circuit of electron tube 20.

When hand set 49 was removed from the switch hook 7 the springs 10, 11 and 12 were brought in contact which causes current from battery across terminals 42—43 to flow through transmitter circuit of primary 21 of transformer 25.

The circuit is now ready for use, when transmitter 5 is spoken into a varying current is set up in primary 26 of transformer 25. This in turn is induced into secondary 27. These impulses then travel to grid 28 of electron tube 20, filament 30, back to the other side of secondary 27, causing a difference of potential to be imposed on grid 28. The vibrations are then amplified in tube 20 and transmitted to primary 33 of transformer 32 and are induced in secondary 34. They then travel from secondary 34 to springs 37 and 38 of relay 36, wire 15, springs 59 and 58 of switch hook 57, loud speaker receiver 53, wire 17, back to secondary 34. This operates loud speaker receiver 53 and all other loud speaker receivers that might be connected on the circuit.

As soon as the person called is located he goes to the neare t station and removes the telephone set from the switch hook which changes the circuit as follows: If telephone set 63 at station 51 is removed from switch hook 57, springs 59, 50 and 61 make temporarily as main spring 60 goes up, the circuit at this point is as follows: from negative terminal 42, springs 22 and 23 of relay 21, to relay 35, wire 15, springs 59, 50 and 61, wire 16 to positive terminal 43. This causes relay 35 to operate pulling down armature 36 momentarily but springs 37 and 38 are brought in contact causing current to flow from negative terminal 42 to springs 22 and 23 of relay 21, to relay 35, springs 38 and 37 to positive terminal 43, thus supplying current to hold down relay 35 as long as relay 21 is held down. This disconnects wire 15 from secondary 34 of transformer 32, spring 40 is separated from 39 and connects wire 15 to the secondary 27 of transformer 25 thus disconnecting all loud speakers. Varying current then flows from secondary 27 of transformer 25 through wire 47, springs 41 and 40 of relay 35, wire 15 to receiver 4 at station 1 to springs 10 and 11, wire 16, also from wire 15 to receiver 54 at station 51 to springs 60 and 61 to wire 16. From wire 16 the circuit is completed through resistance 46 to secondary winding 27. This causes the varying current to operate the phone receivers and conversation is possible between telephone sets. If these sets are not off the switch hook at the other stations current is prevented from operating them as springs 10 and 11 are broken.

When conversation is completed both par-

ties hang the telephone set up, this breaks springs 10, 11 and 12 at the station, thus opening the current holding down relay 21 which is then released. Springs 22 and 23 are thus broken opening up the current holding down relay 35, releasing this relay. All other springs on relay 21 are also broken thus opening all circuits. No current is therefore flowing and the system is restored to normal ready to receive another call.

I have illustrated the audio frequency amplification system as including but one electron tube merely as indicative that a multiple number of electron tubes having their input and output circuits coupled by voice frequency transformers may be used for purpose of increasing the amplitude of the received energy at each of the stations to any desired degree. It will be observed that the system may be economically operated in that the amplifying appartus is located in the central station and it is not necessary to place individual amplifiers at each of the loud speaker stations.

I have illustrated preferred embodiments of the invention, but I desire that it be understood that modifications may be made and that no limitations upon the invention are intended other than are imposed by the scope of the appended claims.

What I claim and desire to secure by Letters Patent of the United States is as follows:

1. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker, an automatic switching device and a telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations said receiver set being normally supported by said switching device for controlling the operation thereof, means at said central station whereby all of said loud speakers may be simultaneously actuated from any one of said plurality of stations, and means at said central station under control of another of said stations by the removal of said receiver set from said switching device whereby said loud speakers can be rendered inoperative and communication established between the telephone transmitter and receiver sets at two of said stations.

2. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, and means located in said central station and arranged to be actuated from any one of said stations for rendering said loud speakers inoperative and establishing private communication between the telephone transmitter and receiver sets of two of said stations.

3. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, and switching means located in said central station and arranged to be actuated from any one of said plurality of stations for rendering said loud speakers inoperative and establishing connections between said telephone transmitter and receiver sets at any two of said stations.

4. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, and switching means located in each of said plurality of stations and in said central station and arranged to be actuated by movement of any one of said plurality of stations to actuated position for operating said loud speakers simultaneously, and means under control of any of the others of said plurality of stations for disconnecting said loud speakers and establishing connection between the telephone transmitter and receiver sets at any two of said plurality of stations.

5. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, and switching and amplifying means located at said central station and arranged to be controlled from any one of said plurality of stations for interposing said amplifying means in circuit with all of said loud speakers, and means under control of another of said plurality of stations for disconnecting said loud speakers from said amplifying means and completing connections between the telephone transmitter and receiver sets at any two of said stations.

6. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, switching means located in each of said plurality of stations and in said central station, electron tube amplification means in said central station, means

controlled from any one of said plurality of stations for connecting the transmitter at said station with the input side of said electron tube amplification means, and connecting the output side thereof with said loud speakers for simultaneously controlling said loud speakers from one of said transmitters, and means under control of another of said plurality of stations for disconnecting all of said loud speakers from said amplification means and establishing connection between the telephone transmitter and receiver sets at any two of said stations.

7. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, an electron tube amplification system located at said central station and having input and output circuits, means for controlling the impedance of said input circuit of said amplification system from any one of said plurality of stations, switching means at said central station and controlled by actuation of one of said plurality of stations for rendering effective the impedance variations of said output circuit upon all of said loud speakers and means under control of another of said plurality of stations for disconnecting said loud speakers from said amplification system and establishing connection between said transmitter and receiver sets at any two of said plurality of stations.

8. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, an electron tube amplification system located at said central station and having input and output circuits, means for controlling the impedance of said input circuit of said amplification system from any one of said plurality of stations, switching means at said central station and controlled by actuation of one of said plurality of stations for rendering effective the impedance variation of said output circuit upon all of said loud speakers, switching means operated by actuation of a second of said plurality of stations for rendering said loud speakers inoperative and completing a talking circuit between the transmitter and receiver sets at any two of said plurality of stations, and means for indicaing the initiation of a call from any one of said plurality of stations to said central station at each of said other plurality of stations.

9. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, means whereby all of said loud speakers may be simultaneously actuated from any one of said plurality of stations, switching means under control of a second of said stations for rendering said loud speakers inoperative and establishing a talking circuit between the telephone transmitter and receiver sets at said first and second mentioned stations, and means for indicating at each of the others of said plurality of stations the initiation of a call from any one of said plurality of stations to said central station.

10. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, said central station including an electron tube amplification system and switching equipment for controlling the interconnection of any two of said stations to the exclusion of the others, a source of alternating current, and means for supplying power for said amplification system and said switching equipment from said source of alternating current.

11. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, said central station including an electron tube amplification system and switching equipment for controlling the interconnection of any two of said stations to the exclusion of the others, a source of alternating current, means for rectifying said current for energizing said amplification system and said switching equipment, and means for eliminating the hum of the alternating current in the telephone system.

12. A telephone intercommunicating system comprising in combination a central station, a plurality of separate transmitter and receiver stations connected by line wire with said central station, a loud speaker and telephone transmitter and receiver set located at each of said plurality of transmitter and receiver stations, said central station including an electron tube amplification system and switching equipment for controlling the interconnection of any two of said stations to the exclusion of the others, a source of alternating current, means for rectifying

said current for energizing said amplification system and said switching equipment, an electron tube rectifier for rectifying said alternating current, connections between said electron tube rectifier and said electron tube amplification system for supplying rectified energy to said electron tube amplification system and a circuit interposed between said rectifier and said amplification system for eliminating the hum of said alternating current in said telephone system.

In testimony whereof I affix my signature.

THELLWELL R. COGGESHALL.