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COMMUNICATION SYSTEM

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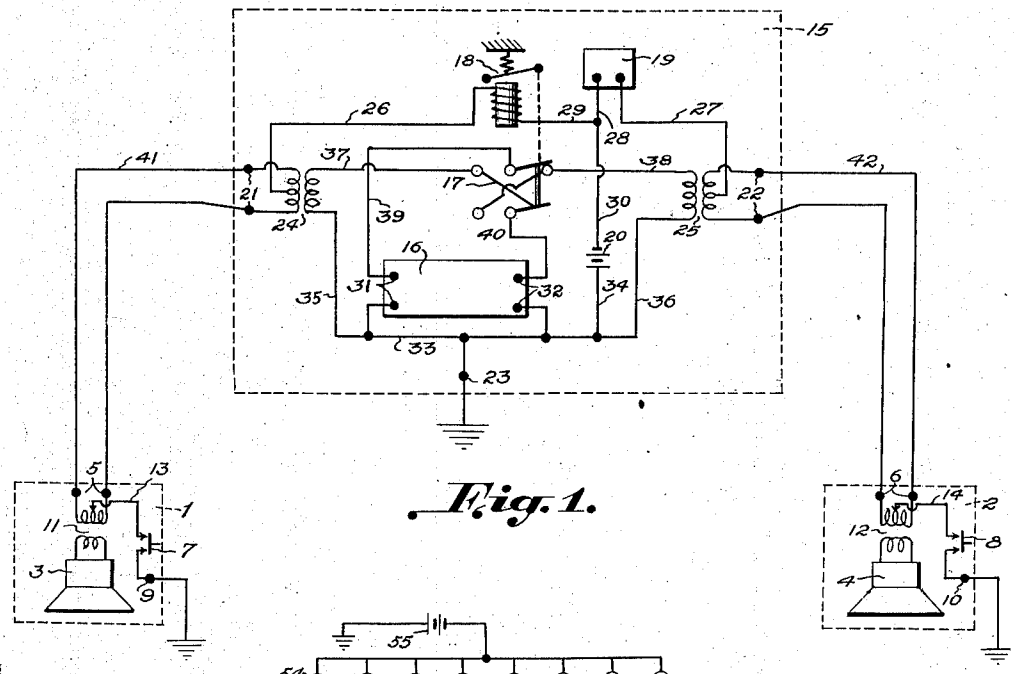


Fig. 1.

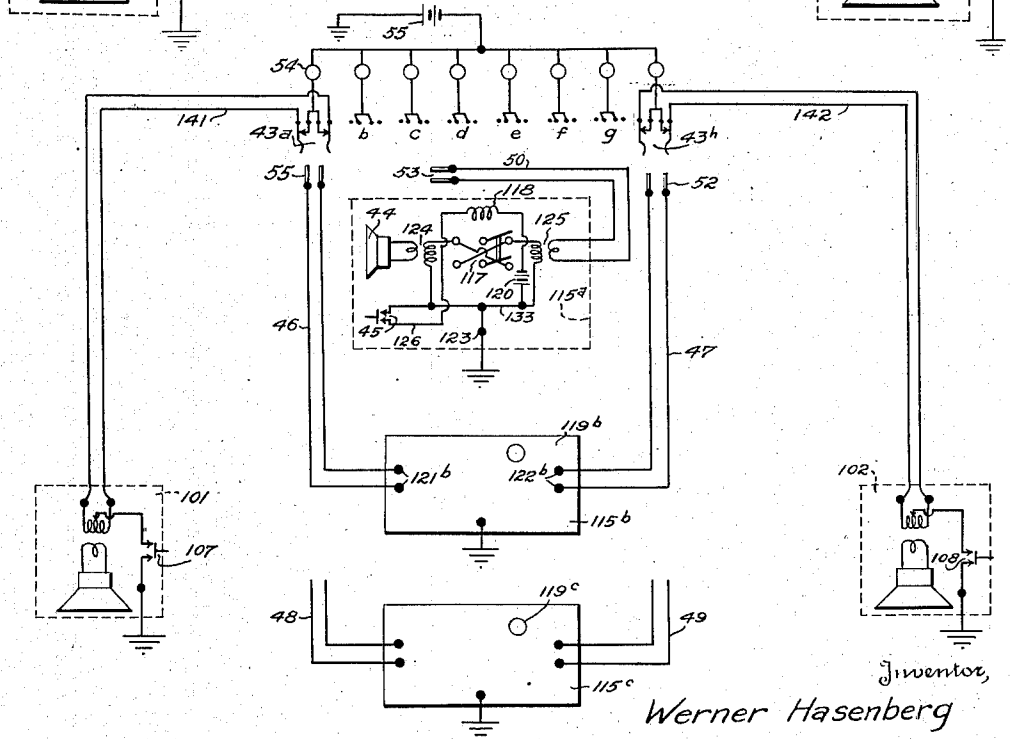


Fig. 2.

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COMMUNICATION SYSTEM

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5 Claims. (Cl. 179—1)

The present invention relates to communication systems and more particularly to intercommunicating systems of the loudspeaking type comprising a large number of stations each equipped with a speaker unit which serves also as transmitting means and wherein two-way conversation may be established between any of two stations.

Loudspeaking communication systems are known to the art built up by so called master stations each comprising a dynamic speaker of the moving coil type, suitable amplifier means, a communication direction control switch and switch means for selecting the lines for transmitting to a selected station. For master stations of this type, generally $n+1$ interstation conductors or channels must be provided for each station, i. e. one for receiving from and n for transmitting to other stations, thereby being n equal to the number of stations with which it is desired to communicate. Considering also the fact that it happens very seldom that all the stations provided in such system are being in the state of communication at the same time, it results that practically a certain number of amplifiers is always destined to lay idle.

One of the primary objects of the present invention is to provide an arrangement allowing to organize a communication network of a large number of stations operated by only a few number of amplifiers sufficient to correspond the requirements accordingly to the average of daily communication to be effected. This is attained by combinations and arrangements similar to the telephonic P. B. X system, locating a group of amplifiers at a central-office and connecting each station by means of its communication channel to a switchboard circuit at the central-office.

A more specific object is to provide means permitting the direction of communication to be controlled by the remote stations. This is attained by a particular arrangement of a communication control unit which combines the amplifier, the reversing switch and control circuit means to an exchangeable communication circuit element adapted to be inserted between the calling and the called stations' communicaton channels.

Another object is the simultaneous use of the proper communication channels for both transmitting and controlling as well as for conveying signals to the operator, at the central-office. While those arrangements and combinations are conventional to the prior art and partly utilized in telephonic-circuits, the specific arrangement described later on in detail is novel and characteristic of the present invention.

Further objects and advantages of the present invention will become apparent from the insuing description in the course of which reference is had to the accompanying drawing in which:

Figure 1 is a schematic diagram illustrating the entire communication circuit between two remote stations including the communication control unit.

Figure 2 shows a schematic diagram of a P. B. X system of loudspeaking intercommunication in which the invention is embodied.

Referring first to Figure 1, the reference numerals 1 and 2 designate two stations of equal construction and circuit, each having a speaker unit 3 and 4 respectively, input terminal 5 and 6 respectively and the push-to-make switch 7 and 8 respectively. It is further provided in the stations single terminals 9 and 10 and transformers 11 and 12, the latter being with one winding—the line side winding—connected across the input terminals 5 and 6 respectively. The other winding of transformers 11 and 12 leads to the moving coil of the speaker unit. The line side winding of transformers 11 and 12 have a centertap which is connected to the single terminal 9 and 10 respectively by means of conductor 13 and 14 including switch 7 and 8 respectively.

The circuit arrangement enclosed within rectangular 15 represents what I desire to call the communication control unit, containing an amplifier 16, a communication direction control or reversing switch 17, an electromagnetic device 18, signaling device 19 which may be a lamp or the like, a source of voltage 20, inlet and outlet 21 and 22 respectively, a ground terminal 23 and two transformers 24 and 25.

Dealing now with the inner circuit of the communication control unit 15, it will be seen that the inlet and outlet transformers 24 and 25 respectively are with their line side winding connected across the inlet and outlet terminals 21 and 22 respectively. The line side windings of these transformers are centertapped, the centertap of the line side winding of transformer 24 being connected over conductor 26 to the electromagnetic device 18, whereas the centertap of transformer winding 25 leads over conductor 27 to lamp 19. The other ends of lamp 19 and electromagnetic device 18 are connected by conductors 28 and 29 to conductor 30 which leads to the source of voltage 20.

The input and output terminals 31 and 32 of amplifier 16 have one of their terminals connected to a common or bus wire 33 which leads to ground terminal 23. Also the source of voltage

20 and the primary windings of transformer 24 and 25 have one of their ends connected to the common conductor 33 by conductors 34, 35 and 36 respectively.

The other ends of the primary windings of transformers 24 and 25 and the ungrounded terminals of input and output of amplifier 16 are connected to the reversing switch 17 by means of conductors 37, 38, 39 and 40 respectively.

As it is shown in Figure 1 the communication control unit 15 is connected to the stations 1 and 2 by communication channels 41 and 42, the first outgoing from inlet terminals 21 leading to input terminals 5 and the second interconnecting the outlet terminals 22 of the control unit with the input terminals 6 of station 2.

The reversing switch 17, in order to control its position, is combined with and operated by the electromagnetic device 18. The communication direction control switch 17 is shown in its normal position which is defined by the fact that the output of amplifier 16 leads to the inlet transformer 24 and the input to the outlet transformer 25.

Dealing now with the operation of the system shown in Figure 1 it is supposed that the party at station 1 is listening to the speech transmitted by the party at the station 2, it will be seen that the voice induced currents travel from terminal 6 of station 2, over communication channel 42 to the communication control unit 15 reaching thereat their outlet terminals 22. The voice induced currents are conveyed farther on over transformer 25, conductor 38, direction control switch 17, and conductor 39 to the input 31 of amplifier 16. The amplified sound currents leave the output 32 and travel over conductor 40, direction control switch 17, conductor 37 to transformer 24, leaving the communication control unit 15 at inlet terminals 21, entering communication channel 41 and go on up to input terminals 5 of station 1.

With the intention to transmit in the opposite direction, which happens when communication direction control switch 17 is reversed to its second position, all what the party at station 1 has to do, is closing the switch 7 provided at the station. By doing so, a control circuit is completed, thereby operating the electromagnetic device 18 embodied in the control unit 15. The normally open and now closed control circuit is built up in the following manner: Outgoing from ground terminal 23 of the unit 15 over common conductor 33, and conductors 34 and 30 including the battery 20, a control current flows over conductor 29 thru the electromagnetic device 18 and reaches over conductor 26 the centertap of the line side winding of transformer 24 and from there travelling farther on to the inlet terminals 21 leaving the unit 15 and is carried on by communication channel 41 up to station 1 where it enters the line side winding of transformer 11, and going on over centertap of the latter to terminal 9 of the station. The circuit is completed by the ground connections of station and control unit. The arrangement now described enables the party at station 1 to control the communication solely by operating the push-to-make switch 7, as well as to use the proper communication channel 41 for simultaneously carrying on both sound and control currents.

The signal circuit embodied in the system of Figure 1, like the control circuit is normally open. When the party at station 2 desires to emit a signal to the communication control unit (to attract the attention of the operator thereat, as it will be described later on) switch 8 at station 2 has to be closed, thus completing the signal circuit. When this is done the signalling device 19 at control unit 15 will be operated, for instance, causing a lamp or the like to enter in function. The signal circuit itself is represented by: ground terminal 23 of control unit 15, conductors 33 and 34, source of voltage 20, conductors 30 and 28, indicator, conductor 27, centertap of the line side winding of transformer 25, communication channel 42, line side winding of transformer 12 at station 2, centertap of the latter, conductor 14 including switch 8, terminal 10 and the completion by the ground connections of station 2 and control unit 15. The arrangements and combinations described and illustrated in Figure 1, have given best results, and the communication effected between two stations located at a distance of quite a mile has proved to be free of failures and disturbances or other difficulties.

The embodiment of the invention illustrated in Figure 2 shows the application of the principles thereof to a system wherein a large number of stations may be associated to a central office including a switch board circuit, in a similar manner as it is made in telephone systems. Figure 2 shows the coordination of circuits and apparatus needed for such a P. B. X system, having been omitted therein those elements and connections which are not required for the understanding of the operation and construction. The elements denominated in Figure 2 as 101, 102, 120, etc., correspond to those denominated 1, 2, 20, etc., in Figure 1.

In Figure 2, only two remote stations 101 and 102 are shown; their communication channels 141 and 142 respectively lead to the central-office and are connected thereat to the line jacks 43*a* and 43*h* respectively. Only 8 line jacks 43*a* to 43*h* are shown forming part of the switch board circuit to be described later on. Three communication control units 115*a* to 115*c* located at the central office are shown in Figure 2. The communication control units 115*b* and 115*c* are identical to that demonstrated in Figure 1, whereas the control unit 115*a* has been adapted in order to serve for what may be called the operator's set. This unit 115*a* is combined with a speaker unit 44 which is connected directly to the inlet transformer 124 as it is shown in Figure 2. The only circuit modifications provided consist in the following: First, conductor 126, outgoing from one terminal of electromagnetic device 118, is connected to the common conductor 133 including a normally open switch 45, and second, the centertap of the line side winding of outlet transformer 125 is not used, owing to the fact that a signal device for the operator's set is unnecessary. The two communication control units 115*b* and 115*c* as well as the operator's set are completed by cords 46, 47, 48, 49 and 50 at the ends of which plugs 51, 52, 53 are provided (the plugs of cords 48 and 49 of control unit 115*c* are not shown). Referring to the switch board circuit, line jack 43*a* has its inner contacts connected in series with line-lamp 54 and battery 55, the battery being grounded. All the other line jacks and line lamps are connected in a similar manner.

To explain the operation of this system it is supposed that the party at station 101 desires to call station 102. To attract the attention of the operator, switch 107 must be closed. Due to this fact the line lamp 54*a*, pertaining to line jack 43*a*, lights on. The operator answers this signal by

inserting plug 53 of cord 50 into the line jack 43a of the calling party. The inserting of this plug does two things: first, the contacts will be spread apart disconnecting the line lamp circuit, allowing the line lamp to extinguish. Second, the operator's set becomes conditioned to communicate with the calling station, the operator is thus enabled to transmit to and to listen from station 101 by respectively closing and releasing switch 45.

The operator, after having obtained the desired number from the calling party, removes plug 53 from the jack and inserts plug 51 into line jack 43a and plug 52 into line jack 43h. Since that moment, the two communication channels 141 and 142 are interconnected and ready to carry on communication between stations 191 and 192. The plugs 51 and 52 pertain to communication control unit 115b which for this example was supposed to be unbusy. It will be understood that by inserting the plugs into the jacks their respective line lamps are disconnected. In the circuit shown in Figure 2 cords 46 and 47 lead to the inlet and outlet transformers respectively of unit 115b and accordingly to the explanation given by description of Figure 1, station 101 becomes enabled to control the communication whereas station 102 may complete the signal circuit. Being so the party 101 operates switch 107, closing it for and keeping it closed during the period of transmitting. The party at station 102 does not make any manipulation until the moment the conversation has finished. In order to advise the operator at the central office to clear the connections, the party at station 102 closes switch 108 for a moment, thereby completing the signal circuit which results in that indicator lamp 119b provided at communication control unit 115b lights on.

By means provided in combination with the cord circuit but not shown in Figure 2, lamp 119b extinguishes when the operator removes the plugs from the jacks, thus clearing the connections of the communication channels 141 and 142. The communication control unit itself becomes ready to serve for other communications.

If there are, say 60 stations in a network, generally 6 or 8 communication control units are sufficient to attain the desired communications according to the average of the daily conversations.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims, in which it is my intention to claim all novelty inherent in the invention as broadly as permissible, in view of the prior art.

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

1. An intercommunication system comprising a central office; a plurality of remotely located stations; communication channels between the stations and the central office; a group of communication control units located thereat; each communication control unit having inlet and outlet terminals adapted to be connected to any two of said remotely located stations through their respective communication channels for establishing a communication circuit between said two stations, each communication control unit including in combination, an amplifier, an electromagnetic device responsive to control current, a reversing switch forming part of the communication circuit for controlling the direction of the communication being operatively associated with and having its position controlled by said electromagnetic device, means including said electromagnetic device and said inlet terminals providing a normally open control circuit extending through that of the two communication channels which has been connected to said inlet terminals; each of said stations having a speaker unit adapted to function as microphone and means including a normally open switch permitting the electric center point of the communication channel to be grounded; the communication circuit established between two of said stations by inserting a communication control unit at the central office being characterized by the fact that said control circuit may be completed and the direction of communication thereby reversed upon closing of said switch belonging to that of the two stations which has been connected to said inlet terminals of said communication control unit at the central office.

2. An intercommunication system comprising a central office; a plurality of remotely located stations; communication channels between the stations and the central office; a group of communication control units located thereat; each communication control unit having inlet and outlet terminals adapted to be connected to any two of said remotely located stations through their respective communication channels for establishing a communication circuit between said two stations, each communication control unit including in combination, an amplifier, an indicator device responsive to signal current, an electromagnetic device responsive to control current, a reversing switch forming part of the communication circuit for controlling the direction of the communication being operatively associated with and having its position controlled by said electromagnetic device, means including said electromagnetic device and said inlet terminals providing a normally open control circuit extending through that of the two communication channels which has been connected to said inlet terminals and means including said indicator device and said outlet terminals providing a normally open signal circuit extending through the other channel which has been connected to said outlet terminals; each of said station having a speaker unit adapted to function as microphone and means including a normally open switch permitting the electric center point of the communication channel to be grounded; the communication circuit established between two of said stations by inserting a communication control unit at the central office being characterized by the fact that said control circuit may be completed and the direction of communication thereby reversed upon closing of said switch belonging to that of the two stations which has been connected to said inlet terminals whereas said signal circuit may be completed and a signal given to the communication control unit upon closing of said switch belonging to the other station which has been connected to said outlet terminals of said communication control unit at the central office.

3. A communication control unit for use in an intercommunicating system of the loudspeaking type wherein speaker units at remote stations are adapted to function as microphones, including in combination, inlet and outlet terminals adapted to be connected to communication channels outgoing from remote stations, two

transformers, each having its centertapped secondary winding directly connected to said inlet and outlet terminals respectively, an amplifier, an electromagnetic device responsive to control current, a reversing switch operatively associated with and having its position controlled by said electromagnetic device, a common conductor leading to one of the terminals of the input and output of said amplifier as well as to one of the ends of the primary windings of said inlet and outlet transformers, the other ends of the primary windings of said transformers as well as the other terminals of the input and output being connected to the terminals of said reversing switch in such a way that the output leads to the inlet transformer and the input to the outlet transformer when the reversing switch is in its normal position, a single terminal connected to said common conductor permitting the control unit to be grounded, an indicator device responsive to signal current, a source of voltage, a normally open control circuit including said electromagnetic device and said source between said common conductor and the centertap of said inlet transformer, and a normally open signal circuit including said indicator device and said source between said common conductor and the centertap of said outlet transformer; being both the control and signal circuits completed by suitable means provided at each station, whereby respectively the direction of the communication becomes reversed and a signal is emitted to said communication control unit.

4. In an intercommunication system, the combination including, at least two remotely located loudspeakers; a two-wire communication channel extending from one loudspeaker to the other; a communication control unit having inlet and outlet terminals inserted into said communication channel at an intermediate point thereon; said communication control unit including in combination, an amplifier, an indicator device, means including a reversing switch for reversing the input and output connections of said amplifier with respect to said loudspeakers, a normally open signal circuit including said indicator device and said outlet terminals extending through that part of the communication channel which is in connection with said outlet terminals, an electro-magnetic device operatively associated with and to control the position of said reversing switch, a normally open control circuit including said electro-magnetic device and said inlet terminals extending through the other part of the communication channel outgoing from said inlet terminals; means located at each loudspeaker and operatively associated therewith including a normally open switch for completing selectively said control circuit or said signal circuit accordingly to the connection of the loudspeaker with respectively said inlet and outlet terminals of said communication control unit.

5. In an intercommunication system, the combination including, at least two remotely located loudspeakers; a two-wire communication channel extending from one loudspeaker to the other; a communication control unit having inlet and outlet terminals inserted into said communication channel at an intermediate point thereon; said communication control unit including in combination, an amplifier for amplifying sound induced currents, an indicator device responsive to signal currents, an electromagnetic device responsive to control currents, means including a reversing switch for reversing the input and output connections of said amplifier with respect to said loudspeakers; means including said electromagnetic device and said inlet terminals at said communication control unit and means including a normally open switch provided at each loudspeaker for conditioning that part of the communication channel which is connected to said inlet terminals to carry on simultaneously both sound and control currents; means including said indicator device and said outlet terminals at said communication control unit to cooperate with said mentioned means at the loudspeaker for conditioning the other part of the communication channel which is outgoing from said outlet terminals to carry on simultaneously both sound and signal currents.

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