

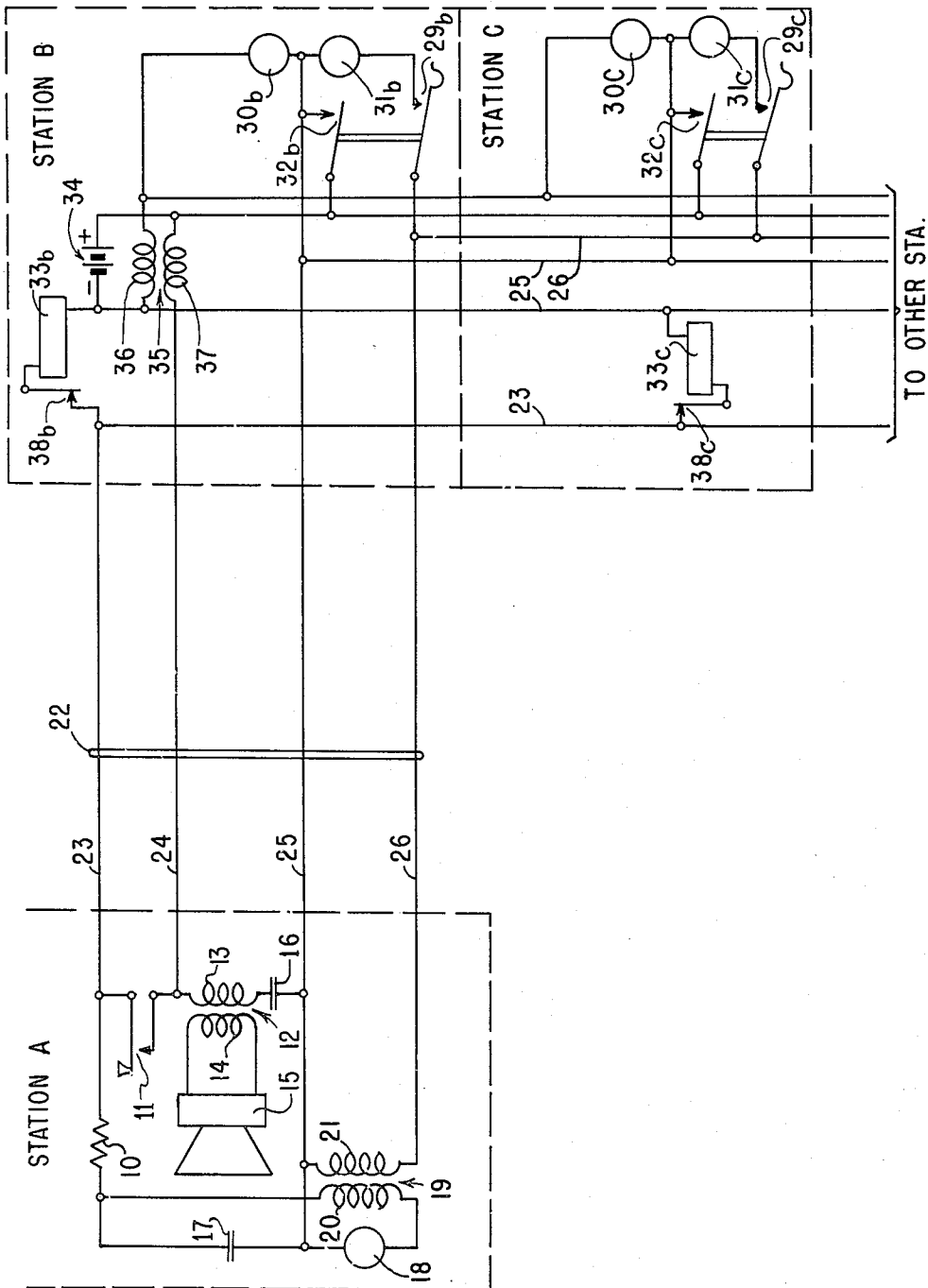
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INTERCOMMUNICATING SYSTEM

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ATTORNEYS

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## INTERCOMMUNICATING SYSTEM

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The present invention relates to telephone systems and more particularly to improvements in intercommunicating telephone and signaling systems of the type in which a loudspeaker is employed at a main or master station, and the usual telephone instrument is used at each subordinate station.

It is an object of the present invention to provide an improved system of the character described wherein the circuit apparatus is arranged in an improved manner to minimize all signal energy losses in the signal transmission channels, and to minimize the number of line conductors used in the line interconnecting the stations.

According to another object of the invention, a separate and direct battery feed circuit to the master station transmitter is provided which utilizes one of the voice transmission conductors and one of the signaling conductors of the line interconnecting the stations.

In accordance with a further object of the invention, an improved arrangement is provided for separating the battery feed circuits from the voice current transmission circuits in order to reduce the losses in the voice current transmission circuits.

It is another object of the invention to provide an improved arrangement for producing a signal at the master station each time a called station is signaled from the master station.

According to another object of the invention, the transmission of the return signal to the master station is dependent upon the operation of the signal device provided at the station being signaled from the master station.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawing, in which the single figure illustrates an improved intercommunicating system characterized by the features of the invention briefly referred to above.

Referring now to the drawing, the intercommunicating system there illustrated comprises a master station A and two subordinate stations B and C, the three stations being interconnected by a four conductor line 22. The system may, if desired, be used to provide communication facilities between the lobby and the several apartments of an apartment building, in which case the equipment of the master station A is located in the lobby of the building and the stations B

and C are located in two different apartments of the building. Alternatively, the system may be used to provide communication facilities between the office of a business executive and the desks of his assistants.

Briefly considered, the equipment provided at the master station A comprises a transmitter 18, a loudspeaker 15, a pair of coupling condensers 16 and 17, a pair of coupling transformers 12 and 19, a current limiting resistor 10, and a call switch 11. Each of the subordinate stations comprises a handset including a transmitter 30 and a receiver 31, a hook or cradle switch, and a buzzer 33. The system further comprises a transformer 35 which is common to the subordinate stations, and a battery 34 which is connected to supply energizing current to the transmitters provided at the several stations. Separate channels are used for transmitting voice currents to and from the master station A. More specifically, the first and second conductors 24 and 25 of the line 22 define a channel for transmitting voice currents to the master station from a called subordinate station, and the second and third conductors 25 and 26 define a second channel for transmitting voice currents to a called subordinate station from the master station. The first conductor 24 is also used in conjunction with the fourth conductor 23 to provide a circuit for controlling the buzzers 33a, 33b, etc., from the master station. The fourth conductor 23 is also used in combination with the second conductor 25 to provide a circuit for energizing the transmitter 18 provided at the master station.

In considering the operation of the system, it may be assumed that a call intended for the subordinate station B is initiated at the master station A. In this regard it is noted that code signaling is utilized selectively to signal the different subordinate stations. Each time the switch 11 is operated, a circuit is completed for energizing the signal buzzers 33a, 33b, etc., in multiple, this circuit extending from the positive terminal of the battery 34 by way of the winding 37, the conductor 24, the contacts of the switch 11, the conductor 23, the contacts 38b, 38c, etc., and the windings of the buzzers 33b, 33c, etc., in multiple to the negative terminal of the battery 34. When thus energized, the buzzers operate to signal the subordinates at the stations B, C, etc. Since, however, the switch 11 is operated in accordance with the code designating the station B, only this station will answer the call.

Incident to the operation of the buzzers 33, a

return signal is transmitted from the station B to station A to indicate that the called station is being signaled. Thus, as the buzzers 33 operate, the contacts 38 thereof are intermittently opened to interrupt the current flow through the winding 37 of the transformer 35. The pulsating current thus caused to flow through the winding 37 of the transformer 35 causes a corresponding alternating voltage to be developed by induction in the winding 36 of the transformer 35. The voltages appearing across the windings 36 and 37 are impressed across the transformer winding 13 over a circuit which includes the battery 34, the transmitters 30 in parallel, the first and second line conductors 24 and 25 and the condenser 16. The resulting alternating current flow through the winding 13 causes a corresponding alternating voltage to be induced in the winding 14 which is reproduced by the loudspeaker as an audible return signal tone.

When the attendant at the station B answers the call by lifting the handset 30b, 31b from its supporting hook or cradle, circuits are completed for energizing the transmitters 30 and 18, that for energizing the transmitter 18 extending from the positive terminal of the battery 34, by way of the contacts 32b, the second line conductor 25, the transmitter 18, the winding 20, the current limiting resistor 10, the fourth line conductor 23, the contacts 38 and the windings of the buzzers 33 in parallel to the negative terminal of battery, and that for energizing the transmitter 30b including the transformer winding 36 and the contacts of the switch 32b. Coincident with the completion of these circuits the hook or cradle switch contacts 29b are closed to bridge the receiver 31b across the line conductors 25 and 26. With the system thus conditioned for operation, signal current traverses the primary winding 20 of the transformer 19 each time the party using the master station equipment speaks into the transmitter 18. More specifically, this current flows in a closed local circuit which includes the indicated winding 20, the transmitter 18 and the condenser 17. A corresponding induced voltage is developed across the terminals of the secondary winding 21, which voltage is applied by means of the second and third line conductors 25 and 26 across the terminals of the receiver 31b for reproduction. In a similar manner, when the answering party at the station B speaks into the transmitter 30b, signal current traverses the primary winding 36 of the transformer 35. A corresponding induced voltage is developed in the secondary winding 37 of this transformer, which is applied by means of the first and second line conductors 24 and 25, and the condenser 16 across the input terminals of the coupling transformer 12. This voltage also appears across the secondary winding 14 of the transformer 12 and is reproduced by the loudspeaker 15 at a sufficiently high transmission level to be readily understood at a point substantially removed from the loudspeaker. It will be understood that when the conversation is terminated and the handset 30b, 31b is restored to its supporting hook or cradle at the subordinate station B, the contacts of the hook or cradle switch 32b are disengaged to interrupt the above-traced circuits for energizing the two transmitters 30b and 18.

The manner in which the subordinate station C or another subordinate station included in the system may be called and conversational circuits set up between this station and the master station

A, will be readily apparent in view of the foregoing explanation.

Since the signal current transmission channels as described above do not include amplifiers, the greatest possible efficiency is required to obtain an adequate loudspeaker volume from the signal currents supplied by the transmitters provided at the subordinate stations, and also to obtain adequate handset receiver volume from the master station transmitter 18 when it is required that this transmitter shall respond to sound waves originating at points two or three feet removed therefrom. To obtain the required volume of reproduction at both the master and subordinate stations the impedances between the various connected elements are carefully matched and the line losses are held to a minimum.

The purpose of providing the line conductor 23 separate from the voice current transmission channels is not alone to provide a simple signaling circuit, but also to keep direct current from traversing the handset receivers 31 provided at the subordinate stations. Moreover, by separating the battery feed circuit for the transmitter 18 from the voice current transmission circuits, the voice frequency currents produced by the transmitter 18 may be confined within the closed low impedance circuit including the primary winding of the transformer 19 and the condenser 17. By virtue of this arrangement the voice frequency currents developed incident to operation of the transmitter 18 are not dissipated as direct current line losses, as would be the case if the battery feed and voice current transmission circuits were not separated. In this regard it is pointed out that the resistor 10 has the function of reducing the magnitude of the current supplied to the transmitter 18 from the battery 34 to a value which is substantially less than that of the current supplied to the transmitter 30b, for example, as provided at the subordinate station B. The latter transmitter may require a normal operating current of approximately 150 milliamperes to provide the requisite output for satisfactory operation of the loudspeaker 15, whereas the optimum current for the remote pickup transmitter 18 provided at the master station A is about 75 milliamperes.

While one embodiment of the invention has been disclosed, it will be understood that various modifications may be made therein which are within the true spirit and scope of the invention.

What is claimed is:

1. In a loudspeaking intercommunicating system, a pair of stations each including transmitter and receiver elements, a four conductor line extending between said stations, the first and second conductors of said line defining a signal channel for transmitting signal currents between said stations in one direction, the second and third conductors of said line defining a second signal channel for transmitting signal currents between said stations in the other direction, and the second and fourth conductors of said line defining a circuit for energizing the transmitter provided at one of said stations.

2. In a loudspeaking intercommunicating system, a pair of stations each including transmitter and receiver elements, a four conductor line extending between said stations, the first and second conductors of said line defining a signal channel for transmitting signal currents between said stations in one direction, the second and third conductors of said line defining a second signal channel for transmitting signal cur-

rents between said stations in the other direction, and the second and fourth conductors of said line defining a normally incomplete circuit for energizing the transmitter provided at one of said stations, and means at the other of said stations for completing said circuit.

3. In a loudspeaking intercommunicating system, a pair of stations each including transmitter and receiver elements, a four conductor line extending between said stations, the first and second conductors of said line defining a signal channel for transmitting signal currents between said stations in one direction, the second and third conductors of said line defining a second signal channel for transmitting signal currents between said stations in the other direction, and the second and fourth conductors of said line defining a normally incomplete circuit for energizing the transmitter provided at one of said stations, a normally incomplete circuit for energizing the transmitter provided at the other of said stations, and a switch at said other station operative to complete both of said circuits.

4. In an intercommunicating system, a pair of stations each including transmitter and receiver elements, a line connecting said stations and including at least four conductors, the first and second conductors of said line defining a channel for transmitting signal currents between said stations in one direction, the second and third conductors of said line defining a channel for transmitting signal currents between said stations in the opposite direction, a signal device at one of said stations controllable over the first and fourth conductors from the other of said stations to produce a signal indication and to produce a return signal voltage, means including the first and second conductors of said line for impressing said voltage across the terminals of the receiving element provided at said other station, a normally incomplete circuit including the second and fourth conductors of said line for energizing the transmitter provided at said other station, and means at said one station for completing said circuit.

5. In an intercommunicating system, a pair of stations each including transmitter and receiver elements, a line connecting said stations and including at least four conductors, the first and second conductors of said line defining a channel for transmitting signal currents between said stations in one direction, the second and third conductors of said line defining a channel for transmitting signal currents between said stations in the opposite direction, a signal device at one of said stations controllable over the first and fourth conductors from the other of said stations to produce a signal indication and to produce a return signal voltage, means including the first and second conductors of said line

for impressing said voltage across the terminals of the receiving element provided at said other station, a normally incomplete circuit including the second and fourth conductors of said line for energizing the transmitter provided at said other station, a normally incomplete circuit for energizing the transmitter provided at said one station, and a switch at said one station operative to complete both of said circuits.

6. In an intercommunicating system, a pair of stations each including transmitter and receiver elements, a line connecting said stations and including at least four conductors, the first and second conductors of said line defining a channel for transmitting signal currents between said stations in one direction, the second and third conductors of said line defining a second channel for transmitting signal currents between said stations in the opposite direction, a buzzer provided at one of said stations and controllable over the first and fourth conductors of said line from the other of said stations to produce an audible signal and to produce a return signal voltage, and means including the first and second conductors of said line for impressing said return signal voltage across the terminals of the receiving element provided at said other station.

7. In an intercommunicating system, a pair of station, each including transmitter and receiver elements, a line connecting said stations to provide two separate signaling channels one of which couples the transmitter element at one of said stations to the receiver element at the other of said stations and the other of which couples the transmitter element at the other of said stations to the receiver element at said one station, a buzzer at said one station controllable over said line from said other station to produce an audible signal and to produce a return signal voltage, and means for impressing said return signal voltage on said one channel.

8. In an intercommunicating system, a pair of stations, a line connecting said stations to provide a signaling channel therebetween, a buzzer at one of said stations controllable over said line from the other of said stations to produce an audible signal and to produce a return alternating current signal voltage, and means for impressing said return alternating current signal voltage on said channel.

9. In an intercommunicating system, a pair of stations, a line connecting said stations to provide a signaling channel therebetween, a signal device at one of said stations controllable over said line from the other of said stations to produce a signal indication and to produce a return alternating current signal voltage, and means for impressing said return alternating current signal voltage on said signaling channel.

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