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TELEPHONE SYSTEM

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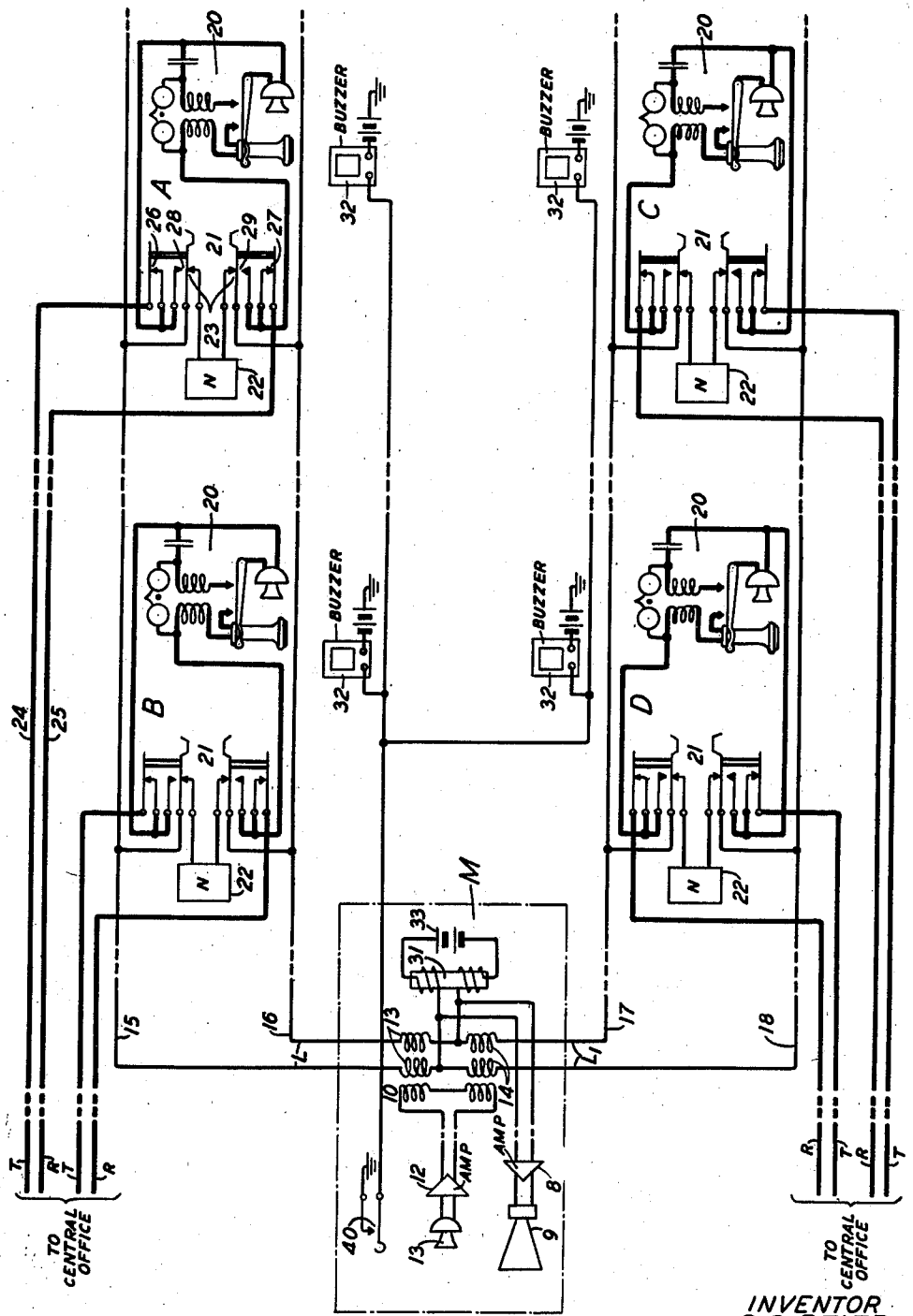

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TELEPHONE SYSTEM

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This invention relates to telephone conference systems and particularly to an improved method of connecting a plurality of multiparty lines with a master station for conference purposes. It is the object of this invention to increase the station capacity of telephone conference systems of the type which utilizes a bridge type transformer or hybrid coil as the connecting medium between a master station equipped with loud-speaking receiver and distant talking transmitter, and groups of subordinate stations which normally have access to and are accessible from a central office.

This object is attained in accordance with a feature of the invention by utilizing both ends of the hybrid coil for speech transmission purposes thereby substantially doubling the station capacity of such systems wherein but one end of the coil is used for the transmission of speech and the other is connected to a balancing network.

Another feature of the invention resides in maintaining a normal condition of balance between the speech transmission channels constituting the conference circuit and in providing means for associating any number of stations with their respective speech channels without disturbing the normal condition of balance. More specifically each branch of the conference circuit, or each speech channel extending from the hybrid coil, has normally connected thereacross a plurality of impedance networks which correspond in number to the number of stations having access to the conference circuit and each of which corresponds in impedance frequency characteristics to those of a particular substation equipment. Each station is equipped with switching means for transferring the telephone set thereat from its individual central office line to the conference circuit and for simultaneously disconnecting from the conference circuit a corresponding impedance network.

These and other features of the invention will be readily understood from the following detailed description made with reference to the accompanying drawing in which the single figure illustrates a conference arrangement embodying the features of the invention.

In the rectangle M shown at the left centre of the drawing there is included the telephone equipment which is located at the master station. This equipment comprises a hybrid coil or bridge type transformer 10 of the well-known three winding type. Across the input winding of this coil there is connected the output terminals of an amplifier 12 whose input terminals are permanently connected to a distant talking transmitter 13. The windings 13 and 14 of the hybrid coil 10 are herein designated first and second line windings since the usual nomenclature applied to these windings, namely line and network windings does not apply in the present arrangement. The line terminals of the winding 13 are permanently connected to the line wires 15 and 16 of one of the speech channels L whereas the line terminals of the winding 14 are permanently connected to the line wires 17 and 18 of the second speech channel L_1. Across the mid-points of coils 13 and 14 a loud-speaking receiver 9 is connected by way of an amplifier 8. Battery supply for the telephone stations may be provided from a common source 30 through the windings of impedance coil 31 as shown, or by means of individual battery supply arrangements for each station. Battery supply for the distant talking transmitter 13 may be supplied in any well-known manner.

At A there is shown a subscriber's station which includes the usual subset equipment as generally indicated at 20, a manually operable key 21 and a balancing network 22. As illustrated, the balancing network 22 is normally bridged across the line wires 15 and 16 of the conference branch, or speech channel L by way of the normal contacts 23 of switch 21. The substation equipment 20 is normally connected to the central office line wires 24 and 25 by way of the normal contacts 26 and 27 of switch 21. Under normal condition of the switch 21 the balancing network 22 is bridged across the conference channel L and the subscriber's set 20 is connected to the central office line comprising conductors 24 and 25. It is to be understood that the impedance of network 22 equals the impedance of the subset 20. When the key 21 is actuated, contacts 23 and 26 and 27 are opened so that the network 22 is disconnected from the conference channel L and the subset 20 is disconnected from its individual central office line circuit. Contacts 28 and 29 are closed by the actuation of switch 21 thereby causing the subset 20 to be connected to the speech channel L.

The hybrid coil 10 serves to connect the transmitting and receiving circuits at the master station in conjugate relation while permitting transmission from the transmitter 13 to both conference branches L and L_1. It also allows transmission from both branches L and L_1 to the loud-speaking receiver 9 while maintaining said branches in conjugate relation to one another.

The equipment at stations B, C and D is identical with that of station A and no further description thereof is deemed necessary. It will be un-

derstood that the balancing networks at each station must have the same impedance as the subset which replaces it when the corresponding key such as 21 is actuated. All of the subsets need not have identical impedance frequency characteristics but each set in branch L however, must have a similar set in branch L_1.

Any suitable method may be employed for signaling between stations. A simple arrangement may comprise a buzzer 32 located at each station and a key 40 at the main station, the latter when operated causing the energization of all station buzzers of the system. It is not necessary that the main station be provided with a buzzer signal since the subscriber thereat may be signaled from another station by the subscriber thereat speaking into his transmitter after the actuation of his key 21. Code signaling would, of course, be resorted to so that each station of the system may be signaled and the subscriber thereat recognize that the call is intended for him.

In the following description it will be assumed that the subscriber at the master station M desires to summon the subscribers at stations A, B, C and D for conference purposes. The key 40 at the master station would be actuated causing the operation of all the buzzers 32 located at the stations A, B, C and D. A particular code may be employed to indicate that the subscribers are being called for conference purposes. Upon receipt of such a signal the subscriber at each station throws his respective switch 21 to its operated position and removes his receiver from its switchhook thereby placing the system in readiness for the transmission of speech. It will be understood that regardless of how many of the subscribers at the stations A, B, C and D respond to the signal, the normal balance of the system is not disturbed since at each station there is normally connected to the conference channels a network having an impedance frequency characteristic similar to that of the associated subset and the substitution of one impedance for a similar one will not affect the impedance of the entire system.

Speech currents generated when the distant talking transmitter 13 at station M is agitated will divide equally between the line coils 13 and 14 and will be transmitted over the speech channels L and L_1 to energize those receivers at stations A, B, C and D which are now connected to their respective speech channels L and L_1. Speech currents generated at the transmitters of the various stations A, B, C and D will pass through the hybrid coil windings 13 and 14 and activate the loud-speaking receiver 9 by way of the amplifier 8. In this manner two-way conversation may be carried on between the master station and the several stations connected to the branches L and L_1. Since with this arrangement the impedances connected to the line branches L and L_1 of the hybrid coil will be practically identical, the voltages impressed on the loud-speaking receiver 9 will be substantially nil when the distant talking transmitter 13 is agitated. It is, therefore, possible to obtain satisfactory volume from the loud-speaker without setting up a singing condition over the electrical circuit from the transmitter to the receiver and the acoustic path from the loud-speaker to the distant talking transmitter. The advantage of the disclosed arrangement is that for a given desired transmission level from and to the master station twice as many telephone stations can be included in the conference as could be used if the sets were all connected to one line winding of the hybrid coil and balancing networks to the other line winding.

Sufficiently good transmission from the telephone sets A and B in branch L of the hybrid coil to telephone sets C and D in branch L_1, or vice versa, will be obtained through the acoustic path between the loud-speaking receiver and the distant talking transmitter at the master station to permit conversation between stations in different branches.

As illustrated in the drawing each substation A, B, C and D is normally connected to a central office line so that the subscribers at these stations may be signaled from the central office and may initiate outside or central office calls in the usual manner.

What is claimed is:

1. In a telephone conference system, a master station having a distant talking transmitter and a loud-speaking receiver, a hybrid coil interconnecting said transmitter and receiver in conjugate relation and having two pairs of line windings, a speech channel connected to each pair of line windings, an impedance network normally connected across each of said speech channels, a telephone set for each of said speech channels normally disconnected therefrom, and means for connecting said telephone sets to their respective speech channels and disconnecting said impedance networks therefrom.

2. In a telephone conference system, a master station having a distant talking transmitter and a loud-speaking receiver, a hybrid coil interconnecting said transmitter and receiver in conjugate relation, a pair of line windings for said coil, a second pair of line windings for said coil, a speech channel connected to each of said pairs of line windings and each having a plurality of impedance networks normally associated therewith, a telephone set for each of said impedance networks and having an impedance frequency characteristic identical to its respective impedance network, and switching means for selectively disconnecting said networks from their respective speech channels and connecting thereto their corresponding telephone sets.

3. In a telephone conference system, a master station having a distant talking transmitter and a loud-speaking receiver, a hybrid coil interconnecting said transmitter and receiver in conjugate relation, a speech channel connected to each pair of line terminals of said coil, a plurality of networks normally connected to each of said speech channels and having impedance values such that a condition of balance is maintained between said channels, a telephone set for each of said networks and having an impedance characteristic corresponding to that of its respective network, and switching means for substituting any of said telephone sets for its corresponding network in said speech channels.

4. In a telephone system, a central office line, a subscriber's station for said line having a telephone set normally connected to said line, a master station, a speech channel, a network having an impedance identical to that of said telephone set, a hybrid coil associated with said master station and having a pair of line terminals permanently connected to said speech channel, and switching means at said subscriber's station for transferring the telephone set thereat from said line to said speech channel and dis-

connecting said network from said speech channel.

5. In a telephone system, a plurality of central office lines, a subscriber's station for each of said lines having a telephone set normally associated with its respective line, a master station, a speech channel, impedance networks corresponding in number to the number of said subscribers' stations normally connected to said speech channel, a hybrid coil interconnecting said master station and said speech channel, and means at each station for transferring the telephone set thereat from its respective central office line to said speech channel and disconnecting a corresponding impedance network from said speech channel.

6. In a telephone system, a plurality of central office lines, a subscriber's station for each of said lines having a telephone set normally connected to a particular line, a master station, a pair of normally balanced speech channels constituting a conference circuit, means comprising a hybrid coil interconnecting said master station with said speech channels, and means at each of said subscriber's stations for disconnecting the telephone set thereat from its respective central office line and connecting it to one of said speech channels.

7. In a telephone system, a plurality of central office lines, a subscriber's station for each of said lines having a telephone set normally connected to a particular line, a master station including a loud-speaking receiver and a distant talking transmitter, a pair of speech channels, a hybrid coil associated with the telephone equipment at said master station and having first and second line windings permanently connected to said speech channels, and means at each of said subscribers' stations for disconnecting the telephone set thereat from its respective central office line and connecting it to one of said speech channels.

8. In a telephone system, a plurality of central office lines, a subscriber's station for each of said lines having a telephone set normally connected to a particular line, a master station including loud-speaking and receiving equipment, a hybrid coil connecting said transmitter and receiver in conjugate relation and having two pairs of line terminals, a speech channel connected to each pair of said line terminals, a plurality of impedance networks connected across each of said speech channels, and means at each of said subscribers' stations for transferring the telephone set thereat from its respective central office line to one of said speech channels and disconnecting one of said impedance networks therefrom.

9. A loud-speaking telephone conference system comprising a pair of speech channels interconnected in conjugate relation by means of a hybrid coil each pair of whose line windings terminates one of said speech channels, a plurality of impedance networks removably connected to each of said speech channels, the total impedance of the networks connected to one of said channels equaling the total impedance of the networks connected to the other of said channels, a subscriber's telephone subset for each of said networks and having an impedance equal to the impedance of its corresponding network, switching means for each of said networks and its corresponding subset which when operated, disconnects the network from its associated speech channel and connects thereto the corresponding subset whereby any number of subsets may be connected to either or both of said speech channels without altering the total impedance of the respective speech channels, a distant talking transmitter inductively associated with said hybrid coil so as to permit speech originating at said transmitter to be transmitted over both said speech channels and a loud-speaking receiver connected to said coil in conjugate relation to said transmitter and in speech receiving relation to each of said speech channels.

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