

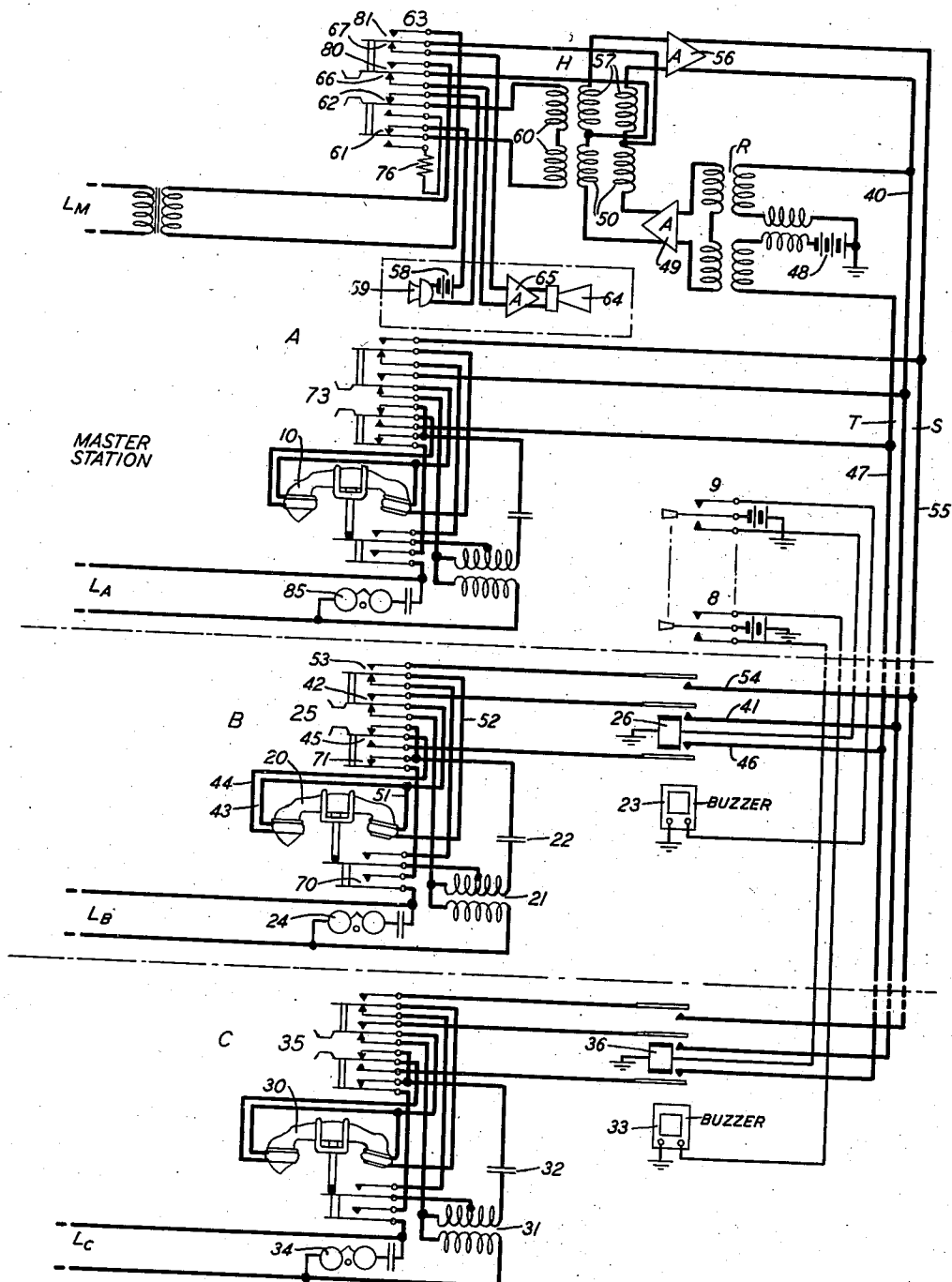
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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This invention relates to telephone systems and particularly to intercommunicating and conference systems.

It is the object of this invention to provide an improved system of intercommunication between a plurality of stations having normal central office or private branch exchange facilities.

This object is attained in accordance with a feature of the invention by an organization of circuits and associated apparatus whereby a subscriber at a master station equipped with a loud-speaking receiver and distant talking transmitter may communicate with the subscribers at one or more secondary stations and whereby the subscribers may employ the standard telephone handset for use on intercommunicating calls as well as on calls originating at, or extended to a central office or private branch exchange.

A particular feature of the invention resides in a novel circuit arrangement involving a bridge type transformer, or hybrid coil whereby the receiver and transmitter elements of the standard handsets located at the several stations of the system may be connected to separate speech channels extending from the two pairs of line windings of the hybrid coil.

Another feature of the invention contemplates the use of switching means at a master station which functions to transform the intercommunicating system into a conference system, whereby the handsets of all the subscribers of the system may be associated with a single central office or private branch exchange line for the purpose of receiving messages of common interest to all the subscribers.

A further feature of the invention resides in the use of switching means at the various stations of the system which function to open the induction coil of the telephone set when the associated handset is employed on the intercommunicating line in order that the subscriber's ringer, associated with the central office or private branch exchange line, may emit an unattenuated signal to indicate an incoming call on the central office or private branch exchange line.

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

Before entering into a detailed description of the operation of the system disclosed, a brief reference will be made to the apparatus located at each of the stations. The system comprises a master station A and a plurality of secondary stations such as B and C. In the drawing the station C is intended to represent the last station of the system, it being understood that other sta-

tions are interposed between this station and station B.

The equipment at each of the secondary stations B and C is identical and comprises a standard telephone set 20 or 30 and associated substation circuit including the induction coil 21 or 31 and condenser 22 or 32, a buzzer 23 or 33, a ringer 24 or 34, a key 25 or 35 and a relay 26 or 36. The ringer 24 or 34 is employed on calls incoming from a central office or private branch exchange and are permanently bridged across their respective lines L_B or L_C. The buzzers 23, 33 are utilized to receive call signals originating at the master station A. A regular central office or private branch call is answered in the usual manner by removing the handset from its cradle support which, as is well known, results in the connection of the subscriber's set to the line L_B or L_C, as the case may be. In response to a buzzer signal, the subscriber at a secondary station actuates the key 25 or 35 and removes the handset from its support, thereby effectively connecting the receiver and transmitter elements of the handset to the intercommunicating line in a manner to be more fully described hereinafter. The relays 26 and 36 are controlled from the master station and function to complete the connection of the secondary subscribers' sets to the intercommunicating line.

The master station A is furnished with the same equipment as the secondary stations except that no buzzer or relay is required, and is also provided with loud-speaking and distant talking facilities and with switching devices whereby the buzzers and relays at the secondary stations may be controlled, and whereby the intercommunicating system may be transformed into a conference system for the purpose of rendering it possible for all the subscribers of the system to be connected to an incoming conference line for the receipt of a message or communication which is of common interest to all.

The following description is directed to the use of the system for intercommunication purposes during which a subscriber at the master station A may selectively signal and communicate with the subscribers at one or more of the secondary stations B, C, etc. For purposes of illustration it will be assumed that the subscriber at the master station A desires to communicate with the subscriber at station B and accordingly actuates the key 9 to the signaling position, that is, upwardly. The buzzer 23 at station B is thereupon actuated to advise the subscriber at station B that a call on the intercommunicating line is awaiting her (or his) attention. After actuating key 9 to the signaling position, the subscriber at station A immediately throws the key 9 to the talking position in which an obvious circuit for relay 26 is completed. The key 9 is left in the

talking position. Relay 26 operates and connects the intercommunicating line to the contacts of key 25 at station B.

Upon hearing the buzzer signal 23, the subscriber at station B actuates the key 25 and removes the handset from its support. The calling and called subscribers may now communicate with one another.

When the key 25 at station B is actuated and the handset 20 removed from its support, two independent circuits are established, one involving the transmitter element of the handset 20 and the other involving the handset receiver element. The transmitter circuit may be traced from common conductor 40, conductor 41, front contact and inner upper armature of relay 26, contacts 42 of key 25, conductor 43, transmitter of handset 20, conductor 44, contacts 45 of key 25, lower armature and front contact of relay 26, conductor 46, conductor 47 which, with conductors 40, forms speech channel T which terminates in the right-hand windings of repeating coil R to which the talking battery 48 is connected. The left-hand windings of repeating coil R are connected to the input terminals of one-way amplifier 49 whose output terminals are connected to the line terminals of the lower line windings 50 of the hybrid coil H.

The other circuit which is effected by the actuation of key 25 and the removal of handset 20 from its support may be traced from the common conductor 40, conductor 41, front contact and inner upper armature of relay 26, contacts 42 of key 25, conductor 51, receiver of handset 20, conductor 52, contacts 53 of key 25, outer upper armature and front contact of relay 26, conductor 54, conductor 55 which, with conductor 40, constitute the other speech channel S, which extends from the output terminals of one-way amplifier 56 whose input terminals are connected to the line terminals of the line windings 57 of the hybrid coil H.

The speech transmitting circuit at the master station extends from battery 58, microphone 59 to the input windings 60 of coil H by way of the normal contacts 61 and 62 of the key 63. The speech receiving circuit at the master station A includes the loud-speaker 64 and one-way amplifier 65 which are bridged across the junction of hybrid coil windings 50 and 57 by way of the normal contacts 66 and 67 of key 63.

From the foregoing description it is apparent that speech currents generated by the microphone 59 at the master station A are impressed upon the input winding 60 of hybrid coil H and the corresponding induced currents in the line windings 57 are amplified at 56 and traverse the speech channel S to activate the receiver element of the handset 20 at station B. It is also evident that the speech currents set up at the transmitter of handset 20 at station B traverse the speech channel T and are impressed upon the right-hand windings of repeating coil R, so that the corresponding induced currents in the left-hand windings of repeating coil R are amplified at 49 and impressed upon the line windings 50 of hybrid coil H, from whence they traverse the normal contacts 66 and 67 of key 63, are amplified at 65 and impressed on the loud-speaker 64. Two-way conversation may be thus carried on between stations A and B.

It is obvious that the subscriber at master station A may converse with the subscriber at any

other secondary station or may communicate with the subscribers at all of the secondary stations simultaneously, if circumstances warrant it. It is only necessary that the key 8 (individual to station C) or a plurality of such keys be first operated to the signaling position and then immediately operated to the talking position in the manner described in connection with the operation of key 9.

It will be noted that when the handset 20 is removed from its cradle, the contact 70 is closed by the cradle plunger, which contact serves to complete the connection of the induction coil 21 to the line L_B. Should this coil be included in the line L_B while the subscriber at station B is conversing on the intercommunicating line, its impedance during a signal transmitting period on line L_B would result in the signal emitted by ringer 24 being attenuated. In order to preclude the possibility of a signal transmitted over line L_B being inaudible to the subscriber at station B while conversing on the intercommunicating line, the contact 71 is provided on the key 25 which effectively opens the induction coil to the line when the key 25 is operated. The ringer 24 will therefore operate as usual on a ringing signal incoming on the line L_B.

In the event that the subscriber at station A desires to call in the subscribers at some or all of the secondary stations for the purpose of hearing a message incoming over the central office or private branch exchange line L_M from a distant point, it is necessary for the keys 8, 9 etc., to be actuated to the signaling position and then operated to the talking position. These key operations signal the desired secondary stations and associate them with the intercommunicating line as before. The subscriber at the master station then actuates keys 73 and 63 and removes the handset 10 from its cradle support while the subscribers at the called secondary stations actuate their keys, such as 25 and 35, and remove their handsets from their respective supports.

The actuation of key 63 at the master station A disconnects the loud-speaker 64 and microphone 59 from the hybrid coil H and substitutes for the former the line L_M, and for the latter the balancing network 76. It is believed unnecessary to describe in detail the results effected by the removal of the handsets 10, 20, 30, etc., from their respective cradle supports and by the actuation of the corresponding keys 73, 25, 35, etc., since these results have already been set forth in connection with the response of the subscriber at station B to an intercommunicating call originated at station A. Suffice it to say that the transmitters of all stations A, B, C, etc., are connected in parallel across the speech channel T and all the corresponding receivers are connected in parallel across the speech channel S. Thus speech currents incoming over the line L_M traverse the line windings 57 of the hybrid coil H, are amplified at 56 and impressed on the speech channel S across which the handset receivers of all stations A, B, C, etc., are connected in parallel. Speech currents generated at any of the handset transmitters of the various stations are impressed on the speech channel T, are amplified at 49 from whence they traverse the line L_M by way of contacts 80 and 81 of key 63, or pass through the hybrid coil windings 50 and 57, are amplified at 56 and impressed upon the speech channel S to be received by the receivers of each of the stations connected to the system.

The gains of amplifiers 49, 56 and 65 of the system are adjusted so as to provide satisfactory transmission between microphone 59 and each receiver of the secondary stations; between each transmitter of the secondary stations and the loudspeaker 64; and between each transmitter and receiver of the various stations. In the case of transmission across the hybrid coil H between transmitter and receiver of the various stations, the gains of the amplifiers are adjusted so that the effect of the air path between the loudspeaker 64 and microphone 59 is not noticeable.

It is apparent that the subscribers at the various stations may initiate and receive central office calls in the usual manner over lines L_A, L_B and L_C and as hereinbefore mentioned, calls incoming over these lines may be indicated by the operation of the ringers 85, 24 and 34 even though the subscribers at whose stations the ringers are located are communicating on the intercommunicating line.

What is claimed is:

1. In a telephone system, a master station, a plurality of secondary stations each equipped with a telephone handset, a hybrid coil at said master station, a pair of one-way speech channels extending from said coil to said secondary stations, and means for connecting the transmitter and receiver elements of the handsets to separate speech channels.

2. In a telephone 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, a secondary station having a telephone handset comprising a transmitter and a receiver, and means for connecting the handset transmitter across one of said speech channels and the handset receiver across the other of said speech channels.

3. In a telephone 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, an amplifier having its input terminals connected to the line terminals of one of said pairs of line windings, a speech channel extending from the output terminals of said amplifier, a second amplifier having its output terminals connected to the line terminals of the other of said pairs of line windings, a speech channel connected to the input side of said second amplifier, a secondary station having a telephone handset comprising a transmitter and a receiver, and means for connecting the handset receiver across the first of said speech channels and the handset transmitter across the second of said speech channels.

4. In a telephone system, a plurality of central office lines, a subscriber's station for each of said lines and having a handset comprising a transmitter and a receiver, a master station, a pair of speech channels, means comprising a hybrid coil interconnecting the master station with said speech channels, means at each of said subscribers' stations for connecting the handset thereof to its respective central office line, and other means for connecting the transmitter of the corresponding handset to one of said speech channels and the receiver thereof to another of said speech channels.

5. 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 central office line circuit, switching means at said station for disconnecting said distant talking transmitter and said loud-speaking receiver from said hybrid coil and connecting said line circuit thereto, a speech channel connected to each of said pairs of line windings, a telephone handset at said station, and means thereat for connecting the transmitter of said handset to one of said speech channels and the receiver of said handset to the other of said speech channels.

6. In a telephone system, a master station having a microphone and loud-speaker, a hybrid coil interconnecting said microphone and loud-speaker in conjugate relation and having two pairs of line windings, a speech channel connected to each pair of line windings, said speech channels constituting an intercommunicating line, a secondary station equipped with a telephone handset, means at said master station for signaling said secondary station, means controlled from said master station for preparing the handset at said secondary station for connection to the intercommunicating line, and means at said secondary station effective subsequent to the operation of said master station controlled means for connecting the transmitter of said handset across one of said speech channels and the receiver of said handset across the other of said speech channels.

7. In a telephone system, a master station having a microphone and a loud-speaker, a hybrid coil interconnecting said microphone and loud-speaker in conjugate relation and having two pairs of line windings, a speech channel extending from each pair of line windings, a telephone handset at said station, a central office line, a balancing network, means for disassociating said microphone and loud-speaker from said hybrid coil and substituting therefor said network and said central office line, respectively, and means for connecting the transmitter of said handset across one of said speech channels and the receiver of said handset across the other of said speech channels.

8. In a telephone system, an intercommunicating line comprising two separate speech channels, a subscriber's station equipped with a telephone handset comprising a transmitter and receiver, and means for connecting the handset transmitter across one of said speech channels and the handset receiver across the other of said channels.

9. In a telephone system, an intercommunicating line comprising two speech channels, a subscriber's telephone circuit comprising an induction coil and a handset comprising a transmitter and a receiver, a central office line, means for effectively connecting the induction coil to said central office line when said handset is to be used on said central office line, and means for opening said induction coil and connecting the transmitter and receiver to separate of said speech channels when said handset is to be used on said intercommunicating line.

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