

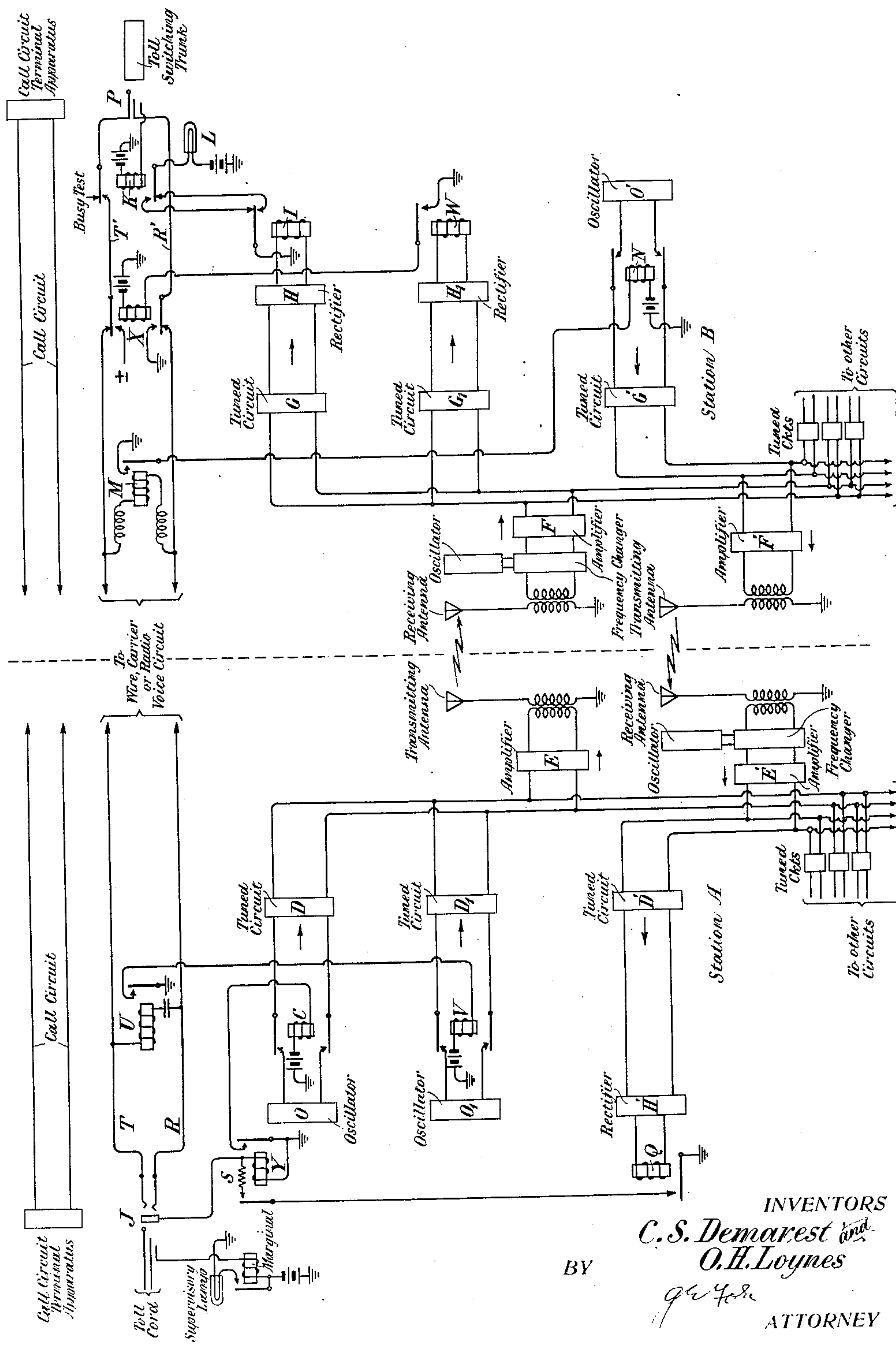
Oct. 23, 1928.

1,688,453

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TELEPHONE SIGNALING SYSTEM

Filed May 19, 1926



Patented Oct. 23, 1928.

1,688,453

UNITED STATES PATENT OFFICE.

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TELEPHONE SIGNALING SYSTEM.

Application filed May 19, 1926. Serial No. 110,251.

This invention relates to telephone signaling systems, and more particularly to arrangements for transmitting supervisory signals between central office stations.

5 In the operation of a group of telephone circuits by improved traffic methods, a number of supervisory signals are required. Facilities for the transmission of these supervisory signals are sometimes not available, 10 as in the case of radio speech channels; and, in the case of wire circuits, they cannot always be obtained unless there are sacrificed facilities for the transmission of Morse telegraph signals over the telephone circuits. 15 Furthermore, with the present standard facilities for signaling over voice circuits, certain precautions must be taken in order to guard against interference with the signals by the voice currents, and in order to reduce 20 the interference from other voice circuits and the interference caused in other voice circuits.

It is the object of applicants' invention to transmit supervisory signals in cases in 25 which the facilities cannot be obtained by wire means, as in the case of radio speech channels, and in the case of wire circuits, to transmit such signals without any sacrifice of Morse telegraph facilities and without any of the types of interference men- 30 tioned above.

Applicants accomplish this object by transmitting all the supervisory signals for a group of voice circuits over a common 35 radio channel between the central office stations.

The arrangement described below and illustrated diagrammatically in the accompanying drawing is one suitable for transmitting by applicants' means the signals employed in the so-called "call circuit" method 40 of operation, in which one pair of wires serves to carry the operators' service conversation in connection with a plurality of talking circuits used for the subscribers' 45 conversation.

With reference to the accompanying drawing, station A is a telephone central office station connected with a distant central office 50 station B by a plurality of voice channels, which may be ordinary wire circuits, carrier circuits, or radio channels. For the sake of simplicity, the system is shown equipped for operation in the direction station A to sta-

tion B only, but it is readily understood that 55 in accordance with applicants' invention the system may be equipped for operation in both directions, a separate group of circuits, like those shown, being provided for operation in the opposite direction. At each sta- 60 tion there are means for transmitting radio signals and means for receiving radio signals. At station A, in association with each of the voice channels there is the following apparatus usually found at such stations: a 65 cord for outgoing calls, a jack for outgoing calls, and an annunciator. In addition, at station A there are two sets of means for producing radio signaling current for transmission, and means for suitably tuning the 70 radio receiver. At station B the following apparatus associated with each of the voice channels is usually found at such central office stations: a plug terminating the voice 75 channel, a toll switching trunk, and an annunciator. At station B, in association with each voice channel, there is one set of means for producing radio signaling current for transmission, and two sets of means 80 for suitably tuning the receiver. A separate call circuit connects stations A and B, with suitable terminal apparatus at each station, this circuit and its terminal apparatus being well understood in the art.

For each voice channel served, there are 85 required two radio signaling frequencies for signaling in the direction station A to station B, the signaling current producers associated with that channel at station A producing alternating currents of two pre- 90 determined frequencies, and the receiver at station B being correspondingly tuned by the circuits associated with that channel to receive the proper one of these two frequencies 95 at the proper time, as will be more fully disclosed below. In the opposite direction, station B to station A, one predetermined radio signaling frequency is required.

It is to be understood that only the apparatus associated with one voice channel is 100 shown in full, the apparatus peculiarly associated with the other channels being merely indicated and its connection to the radio transmitting and receiving apparatus shown.

The details of the signaling system will 105 be clearly understood from the following description of the operation thereof in connection with a call originated at station A

and completed at station B. The operator at station A uses the call circuit to inform the operator at station B with what subscriber a connection is desired. The station

5 B operator assigns a trunk and notifies the operator at station A. The latter then plugs the toll cord arranged for call circuit operation into jack J. Battery from the sleeve of the toll cord causes the operation of relay

10 Y, which in turn, causes the operation of relay C. The operation of relay C connects the oscillator O, which produces a high frequency signaling current, through the tuned circuit D associated with the voice channel

15 under consideration and the common amplifier E to the radio transmitting antenna of station A. The radio signal is received in the receiving antenna at station B, is changed in frequency (an oscillator being

20 associated with the frequency changer), and is passed through the common amplifier F, the tuned circuit G associated with the voice channel under consideration and the rectifier H to relay I, which operates. The operation

25 of relay I completes a grounded circuit through battery including the lamp L associated with the plug P of the incoming circuit, and this lamp is lighted. The operator at station B then inserts the plug P

30 in the toll switching trunk. This connection furnishes ground for the operation of relay K, which operation breaks the circuit including the lamp L and extinguishes the lamp. The insertion of plug P in the toll switching

35 trunk also permits battery to flow from the switching trunk over leads T' and R' to relay M, causing the operation of this relay. The operation of relay M in turn causes the operation of relay N. The operation of the

40 latter relay connects oscillator O', which produces a high frequency signaling current, through the tuned circuit G' associated with the voice channel under consideration and the common amplifier F' to the transmitting

45 antenna of station B. The radio signal transmitted is received in the receiving antenna at station A, is changed in frequency, and is passed through the common amplifier E', the tuned circuit D' associated with the voice channel under consideration, and the

50 rectifier H' to relay Q, which operates. The operation of relay Q connects a resistance S to ground in parallel with relay Y. The value of resistance S is so chosen with respect

55 to the resistance of relay Y that a marginal relay in the sleeve of the toll cord inserted in jack J is caused to operate. The operation of this marginal relay lights the supervisory lamp in the toll cord, as is well understood in the art. The lighting of this lamp

60 indicates to the operator at station A that the circuit is connected to the subscriber at station B and is in condition for the transmission of ringing signals directly to that subscriber.

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The operator at station A then rings on the toll cord, ringing current being transmitted over leads T and R to relay U, which operates. The operation of relay U in turn causes the operation of relay V. The operation of this latter relay connects the second oscillator of station A, O₁, producing a second signaling current, through the second tuned circuit D₁ associated with the voice channel under consideration and the common

70 amplifier E to the transmitting antenna. A second radio signal is sent to station B, is received in the receiving antenna of that station, is changed in frequency, and is passed through the common amplifier F, the second

75 tuned circuit G₁ associated with the voice channel under consideration, and the rectifier H₁ to relay W, which operates. The operation of relay W in turn causes the operation of relay X. The operation of this

80 latter relay connects to the leads T' and R' the current source and ground indicated in the drawing, transmitting ringing current over these leads directly to the subscriber's station. It will be readily understood that the subscriber at station B is rung only while the operator rings at station A.

When the subscriber at station B answers the call, battery from the toll switching trunk is removed from leads T' and R', thereby releasing relay M and, in turn, relay N, the radio signal to station A ceases, relay Q at station A releases, and resistance S is removed from the sleeve of jack J, causing the release of the marginal relay in the toll cord and extinguishing the supervisory lamp.

If the called subscriber at station B operates his switch hook, relay M will follow this operation, that is, relay M will be operated when the hook is down and will be released when the hook is up. From the above description of the operations controlled by relay M, it will be understood that relay N follows the switch hook operations, transmitting radio signal pulses from oscillator O' over the radio channel to station A, where the pulses cause the flashing of the supervisory lamp in the toll cord.

When the operator at station A disconnects the toll cord from the jack J, the radio signal which originated in oscillator O and was transmitted to station B during the call, is removed. The removal of this radio signal causes the release at station B of relay I. Since relay K at station B remains operated, the release of relay I will close the circuit including the lamp L, causing this lamp to light. This lighting of the lamp indicates to the operator at station B that the plug P

125 is to be removed from the toll switching trunk.

It is to be understood that only such partial or schematical disclosure in the drawing of the toll cord circuits at stations A and B

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is made as appears to be necessary to an understanding of applicants' invention. Furthermore, the call circuit, which is an element well understood in the art, is shown with its terminal apparatus merely in schematic form.

While applicants' invention has been disclosed in one specific embodiment which is deemed desirable, it is to be understood that it is capable of embodiment in many other and different forms without a departure from the scope of the invention as defined in the appended claims.

What is claimed is:

1. In a telephone system including two central office stations and a voice channel connecting said stations, means at each station for transmitting radio signals, means at each station for receiving radio signals, a cord at the first station for outgoing calls, a jack for outgoing calls, terminating the voice channel at the first station, a plug terminating the voice channel at the second station, a switching trunk associated with the voice channel at the second station, an annunciator at each station, a first means at the first station for producing signaling current of a first certain frequency, a second means at the first station for producing signaling current of a second certain frequency, a first means at the second station for tuning the signal receiving means at said station to the first frequency produced at the first station, a second means at the second station for tuning said signal receiving means to the second frequency produced at the first station, means at the second station for producing signaling current of a certain frequency, means at the first station for tuning the signal receiving means at said station to the frequency produced at the second station, automatic means at the first station, responsive to the connection of the cord and the jack, for connecting the first current producing means to the radio signal transmitting means at said station, automatic means at the second station for operating the annunciator at said station in response to a radio signal initiated in said first current producing means at the first station, automatic means at the second station, responsive to the connection of the plug and the switching trunk, for terminating the operation of said annunciator, automatic means at the second station, responsive to the connection of the plug and the switching trunk, for connecting the current producing means to the radio signal transmitting means at said station, automatic means at the first station for operating the annunciator at said station in response to a radio signal received from the second station, automatic means at the first station, responsive to ringing current introduced over the cord, for connecting the second cur-

rent producing means to the radio signal transmitter at said station, automatic means at the second station for producing ringing current in the voice channel at said station in response to a radio signal initiated in said second current producing means at the first station, and automatic means at the second station for re-operating the annunciator at said station in response to the termination of the radio signal initiated by the first current producing means at the first station.

2. In a telephone system including two central office stations and a voice channel connecting said stations, an auxiliary call circuit connecting said stations, means at each station for transmitting radio signals, means at each station for receiving radio signals, a cord at the first station for outgoing calls, a jack for outgoing calls, terminating the voice channel at the first station, a plug terminating the voice channel at the second station, a switching trunk associated with the voice channel at the second station, an annunciator at each station, a first means at the first station for producing signaling current of a first certain frequency, a second means at the first station for producing signaling current of a second certain frequency, a first means at the second station for tuning the signal receiving means at said station to the first frequency produced at the first station, a second means at the second station for tuning said signal receiving means to the second frequency produced at the first station, means at the second station for producing signaling current of a certain frequency, means at the first station for tuning the signal receiving means at said station to the frequency produced at the second station, automatic means at the first station, responsive to the connection of the cord and the jack, for connecting the first current producing means to the radio signal transmitting means at said station, automatic means at the second station for operating the annunciator at said station in response to a radio signal initiated in said first current producing means at the first station, automatic means at the second station, responsive to the connection of the plug and the switching trunk, for terminating the operation of said annunciator, automatic means at the second station, responsive to the connection of the plug and the switching trunk, for connecting the current producing means to the radio signal transmitting means at said station, automatic means at the first station for operating the annunciator at said station in response to a radio signal received from the second station, automatic means at the first station, responsive to ringing current introduced over the cord, for connecting the second current producing means to the radio signal transmitter at said station, auto-

automatic means at the second station for producing ringing current in the voice channel at said station in response to a radio signal initiated in said second current producing means at the first station, and automatic means at the second station for re-operating the annunciator at said station in response to the termination of the radio signal initiated by the first current producing means at the first station.

3. In a telephone system including two central office stations and a plurality of voice channels connecting said stations, means at each station for transmitting radio signals, means at each station for receiving radio signals, and the following elements and means associated with each voice channel at their respective stations: a cord at the first station for outgoing calls, a jack for outgoing calls, terminating the voice channel at the first station, a plug terminating the voice channel at the second station, a switching trunk associated with the voice channel at the second station, an annunciator at each station, a first means at the first station for producing signaling current of a first certain frequency peculiar to said station and to the voice channel, a second means at the first station for producing signaling current of a second certain frequency peculiar to said station and to the voice channel, a first means at the second station for tuning the signal receiving means at said station to the first frequency produced at the first station and peculiar to the voice channel, a second means at the second station for tuning said signal receiving means to the second frequency produced at the first station and peculiar to the voice channel, means at the second station for producing signaling current of a frequency peculiar to said station and to the voice channel, means at the first station for tuning the signal receiving means at said station to the frequency produced at the second station and peculiar to the voice channel, automatic means at the first station, responsive to the connection of the cord and the jack, for connecting the first current producing means to the radio signal transmitting means at said station, automatic means at the second station for operating the annunciator at said station in response to a radio signal initiated in said first current producing means at the first station, automatic means at the second station, responsive to the connection of the plug and the switching trunk, for terminating the operation of said annunciator, automatic means at the second station, responsive to the connection of the plug and the switching trunk, for connecting the current producing means to the radio signal transmitting means at said station, automatic means at the first station for operating the annunciator at said station in response to a radio

signal received from the second station, automatic means at the first station, responsive to ringing current introduced over the cord, for connecting the second current producing means to the radio signal transmitter at said station, automatic means at the second station for producing ringing current in the voice channel at said station in response to a radio signal initiated in said second current producing means at the first station, and automatic means at the second station for re-operating the annunciator at said station in response to the termination of the radio signal initiated by the first current producing means at the first station.

4. In a telephone system including two central office stations and a plurality of voice channels connecting said stations, an auxiliary call circuit connecting said stations, means at each station for transmitting radio signals, means at each station for receiving radio signals, and the following elements and means associated with each voice channel at their respective stations: a cord at the first station for outgoing calls a jack for outgoing calls, terminating the voice channel at the first station, a plug terminating the voice channel at the second station, a switching trunk associated with the voice channel at the second station, an annunciator at each station, a first means at the first station for producing signaling current of a first certain frequency peculiar to said station and to the voice channel, a second means at the first station for producing signaling current of a second certain frequency peculiar to said station and to the voice channel, a first means at the second station for tuning the signal receiving means at said station to the first frequency produced at the first station and peculiar to the voice channel, a second means at the second station for tuning said signal receiving means to the second frequency produced at the first station and peculiar to the voice channel, means at the second station for producing signaling current of a frequency peculiar to said station and to the voice channel, means at the first station for tuning the signal receiving means at said station to the frequency produced at the second station and peculiar to the voice channel, automatic means at the first station, responsive to the connection of the cord and the jack, for connecting the first current producing means to the radio signal transmitting means at said station, automatic means at the second station for operating the annunciator at said station in response to a radio signal initiated in said first current producing means at the first station, automatic means at the second station, responsive to the connection of the plug and the switching trunk, for terminating the operation of said annunciator, automatic means at the second station, responsive to the connection of

the plug and the switching trunk, for connecting the current producing means to the radio signal transmitting means at said station, automatic means at the first station for
5 operating the annunciator at said station in response to a radio signal received from the second station, automatic means at the first station, responsive to ringing current introduced over the cord, for connecting the sec-
10 ond current producing means to the radio signal transmitter at said station, automatic means at the second station for producing ringing current in the voice channel at said station in response to a radio signal initiated in said second current producing means at
the first station, and automatic means at the second station for reoperating the annunciator at said station in response to the termination of the radio signal initiated by the first current producing means at the first
20 station.

In testimony whereof, we have signed our names to this specification this 18th day of May 1926.

CHARLES S. DEMAREST.
OWEN H. LOYNES.