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C. S. DEMAREST ET AL

TELEPHONE SIGNALING SYSTEM

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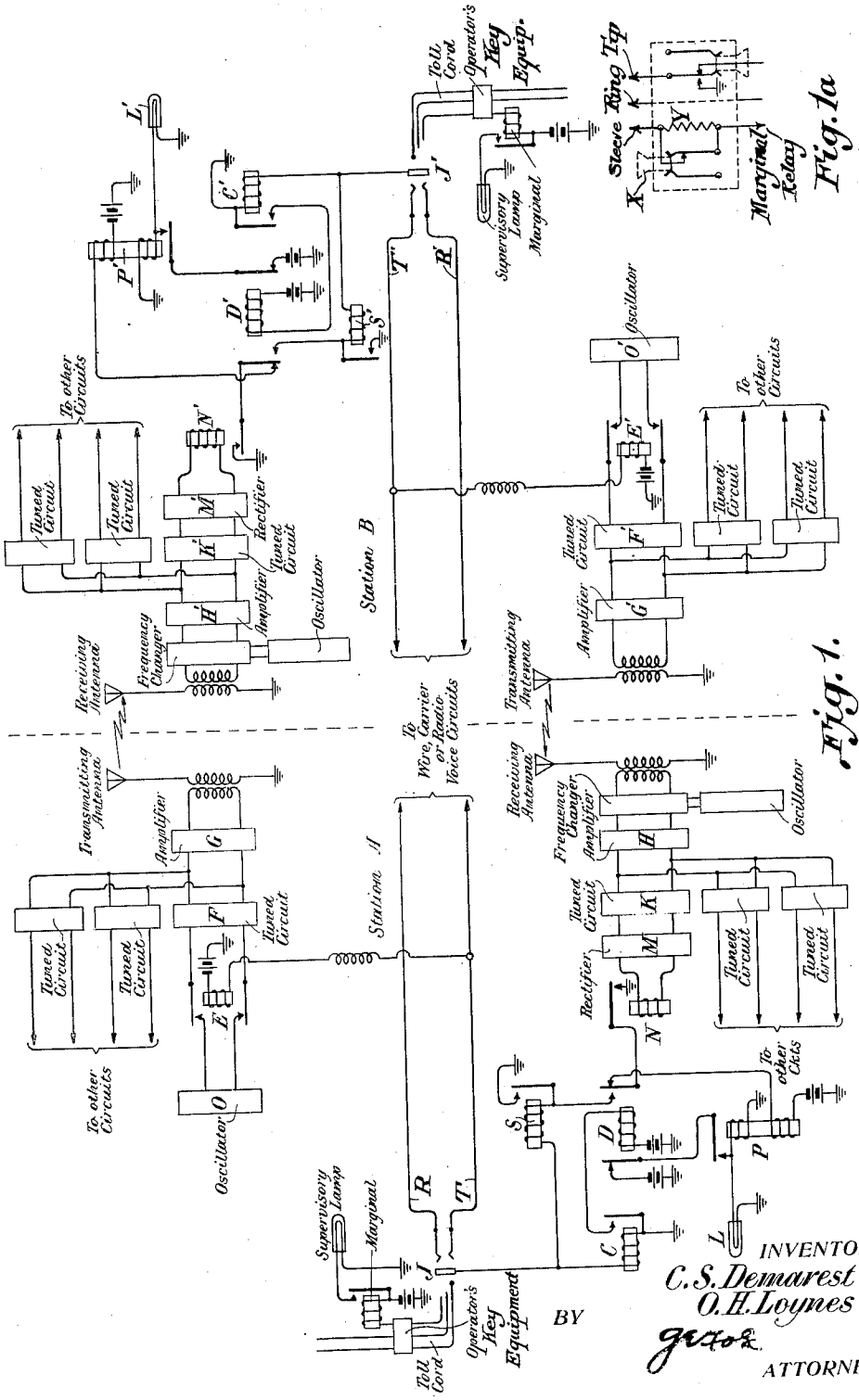


Fig. 1a

Fig. 1.

INVENTORS
C. S. Demarest and
O. H. Loynes
BY
ATTORNEY

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CHARLES S. DEMAREST, OF RIDGEWOOD, NEW JERSEY, AND OWEN H. LOYNES, OF BROOKLYN, NEW YORK, ASSIGNORS TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TELEPHONE SIGNALING SYSTEM.

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

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, 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. 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 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 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 mentioned above.

Applicants accomplish this object by transmitting all the supervisory signals for a group of voice circuits over a common 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 "third wire" method of operation, sometimes called the "third wire method of ring down operation", in which the signals are transmitted from the toll line circuit to the toll cord associated therewith, over a third wire.

Fig. 1 shows diagrammatically and, in part, schematically, a group of circuits suitable for the practice of the invention. Fig. 1[a] shows diagrammatically a detail of one of the cord circuits. It is to be understood that this figure is intended to show only the circuit changes made by certain switching operations and is not to be taken as a representation of the actual structure involved. It is to be understood further that the corresponding detail of the cord circuit at the opposite end of the system is the same as that shown in this figure.

With reference to the accompanying drawing, station A is a telephone central office station connected with a distant central office station B by a plurality of voice channels, which may be ordinary wire circuits, carrier circuits, or radio channels. The system is shown equipped for operation in either direction, that is, for the initiation of a call at either station and the proper signaling and supervision at both stations. The apparatus at each station consists essentially of radio transmitting means, radio receiving means, and the following in association with each of the voice channels: means for producing radio signaling current for transmission, means for suitably tuning the receiving means, the usual annunciators, and means for associating the signaling current producers and the annunciators with the radio transmitting and receiving apparatus, respectively. For each voice channel served there is required one radio signaling frequency for signaling in each direction, the signaling current producer associated with that channel at each station producing an alternating current of a predetermined frequency and the receiver at the other station being correspondingly tuned by the circuit associated with that channel.

It is to be understood that only the apparatus associated with one voice channel is 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 be clearly understood from the following description of the operation thereof.

If a subscriber directly connected with the central office station A wishes to communicate with a subscriber connected to the distant central office station B, the operator at station A plugs the toll cord into the jack J. Battery from the sleeve of the toll cord operates relay C, which, in turn, operates relay D. The operator then rings, and ground is placed over the lead T from the operator's key equipment (see Fig. 1[a]), resulting in the operation of relay E. The

operation of relay E connects the oscillator O, which produces high frequency signaling current, through the tuned circuit F associated with the voice channel under consideration and the common amplifier G to the radio transmitting antenna of station A. A radio signal is received in the receiving antenna at station B, is changed in frequency (an oscillator being associated with the frequency changer), and is passed through the common amplifier H', the tuned circuit K' associated with the voice channel under consideration, and the rectifier M' to the relay N', which operates. The operation of relay N' connects ground over a back contact of relay D to the upper winding of relay P'. Relay P' operates, locks through its lower winding, and completes a circuit including the lamp L' associated with the jack J' The operator at station B, in response to the lighting of the lamp L', plugs the toll cord into jack J'. Battery from the sleeve of this toll cord operates relay C', which, in turn operates relay D'. The operation of relay D' breaks the locking circuit of relay P', releasing that relay, and extinguishes the lamp L'.

If the operator at station A rerings on the circuit established as above, ground is again connected over lead T to relay E, and a second radio signal is transmitted to station B, re-operating relay N'. Since relay D' remains operated, this second operation of relay N' connects ground through the make contact of relay D' and the winding of relay S' to the sleeve of jack J'. The relay S' operates and locks in parallel with relay C', both relays being held operated by the battery from the sleeve of the toll cord inserted in the jack. The resistance of relay S' is chosen to be considerably lower than that of relay C'. Accordingly, when these two relays are connected in parallel, as described above, the marginal relay in the sleeve of the toll cord will operate in a manner well understood in the art and light the supervisory lamp associated with the toll cord. When the operator at station B answers and operates a talking key X (Fig. 1[a]) in the toll cord, the resistance Y is switched in, and the resistance of the toll cord is sufficiently increased thereby to cause the release of relay S', relay C' remaining operated. Consequently the marginal relay in the toll cord releases and extinguishes the supervisory lamp. When the toll cords are removed from the jacks J and J' at stations A and B, respectively, all the relays of the system are restored to the normal condition.

Only so much of the toll cord circuits is shown as appears to be necessary to a full understanding of applicants' invention.

The operation of the signaling system will now be described in connection with a call initiated at station B. The operator at station B plugs a toll cord into the jack J', causing the operation of relay C', which, in turn, causes the operation of relay D'. When the operator rings, ground is placed over lead T' to relay E', which operates. The operation of relay E' connects the oscillator O', which produces high frequency signaling current, through the tuned circuit F' and the common amplifier G' to the radio transmitting antenna at station B. The radio signal is transmitted and received at the distant station A in the receiving antenna, is changed in frequency, and is passed through the common amplifier H, the tuned circuit K, and the rectifier M to the relay N. This relay N operates and connects ground through a back contact of relay D to the lower winding of relay P. The relay P operates, locks through its upper windings, and completes a circuit including the lamp L associated with the jack J, the lighting of this lamp directing the attention of the operator at station A to the call. The receiving operator responds by plugging a toll cord into jack J, causing the operation of relay C, which, in turn, causes the operation of relay D. The operation of relay D breaks the locking circuit of relay P, releasing that relay, and extinguishes the lamp L.

If the operator at the originating station B rerings on the circuit established as described above, ground is again placed over lead T' to the relay E', which again operates, causing a second radio signal to be transmitted to station A, where relay N is re-operated. Since relay D remains operated, the second operation of relay N connects ground through the make contact of relay D and the winding of relay S to the sleeve of jack J. Relay S operates and locks in parallel with relay C, both relays being held operated by battery from the sleeve of the toll cord inserted in jack J. The resistance of relay S is chosen considerably lower than that of relay C. Accordingly, when these two relays are connected in parallel, the marginal relay in the sleeve of the toll cord will operate, lighting the supervisory lamp associated with the toll cord. When the operator at station A answers and operates her talking key in the toll cord, the resistance of the toll cord is sufficiently increased to result in the release of relay S, relay C remaining operated. The release of relay S causes the release of the marginal relay in the sleeve of the toll cord, and accordingly extinguishes the supervisory lamp.

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 generating and transmitting radio signals, means at each station for receiving the radio signals transmitted from the other station, a first annunciator at each station, a second annunciator at each station, automatic means at each station, responsive to ringing current introduced at that station, for operating the signal generating and transmitting means at that station, automatic means at each station for operating the first annunciator at that station in response to an initial radio signal received from the other station, and automatic means at each station for operating the second annunciator at that station in response to a subsequent radio signal received from the other station.

2. In a telephone system including two central office stations and a voice channel connecting said stations, means at each station for generating and transmitting radio signals, means at each station for receiving the radio signals transmitted from the other station, a first annunciator at each station, a second annunciator at each station, automatic means at each station, responsive to ringing current introduced at that station, for operating the signal generating and transmitting means at that station, automatic means at each station for operating the first annunciator at that station in response to an initial radio signal received from the other station, automatic means at each station for operating the second annunciator at that station in response to a subsequent radio signal received from the other station, and automatic means at each station for preventing the re-operation of the first annunciator at that station in response to said subsequent radio signal received from the other 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 at each station in association with each voice channel the following: means for producing signaling current of a frequency peculiar to that station and to that voice channel, means for tuning the signal receiving means at that station to the peculiar frequency produced at the other station and corresponding to that voice channel, a first annunciator, a second annunciator, automatic means, responsive to ringing current produced at that station, for connecting said current producing means to the radio signal transmitting means at that station, automatic means for operating the first annunciator at that station in response to an initial radio signal, of the predetermined frequency, received from the other station, and automatic means for operating the second annunciator at that station in response to a subsequent radio signal, of the predetermined frequency, received from the other station.

4. 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 at each station in association with each voice channel the following: means for producing signaling current of a frequency peculiar to that station and to that voice channel, means for tuning the signal receiving means at that station to the peculiar frequency produced at the other station and corresponding to that voice channel, a first annunciator, a second annunciator, automatic means, responsive to ringing current produced at that station, for connecting said current producing means to the radio signal transmitting means at that station, automatic means for operating the first annunciator at that station in response to an initial radio signal, of the predetermined frequency, received from the other station, automatic means for operating the second annunciator at that station in response to a subsequent radio signal, of the predetermined frequency, received from the other station, and automatic means for preventing the re-operation of the first annunciator at that station in response to said subsequent radio signal received from the other station.

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

CHARLES S. DEMAREST.
OWEN H. LOYNES.