June 9, 1925. 1,540,849

O. H. LOYNES

SIGNAL STORING ARRANGEMENT

Filed May 15, 1924 2 Sheets-Sheet 1

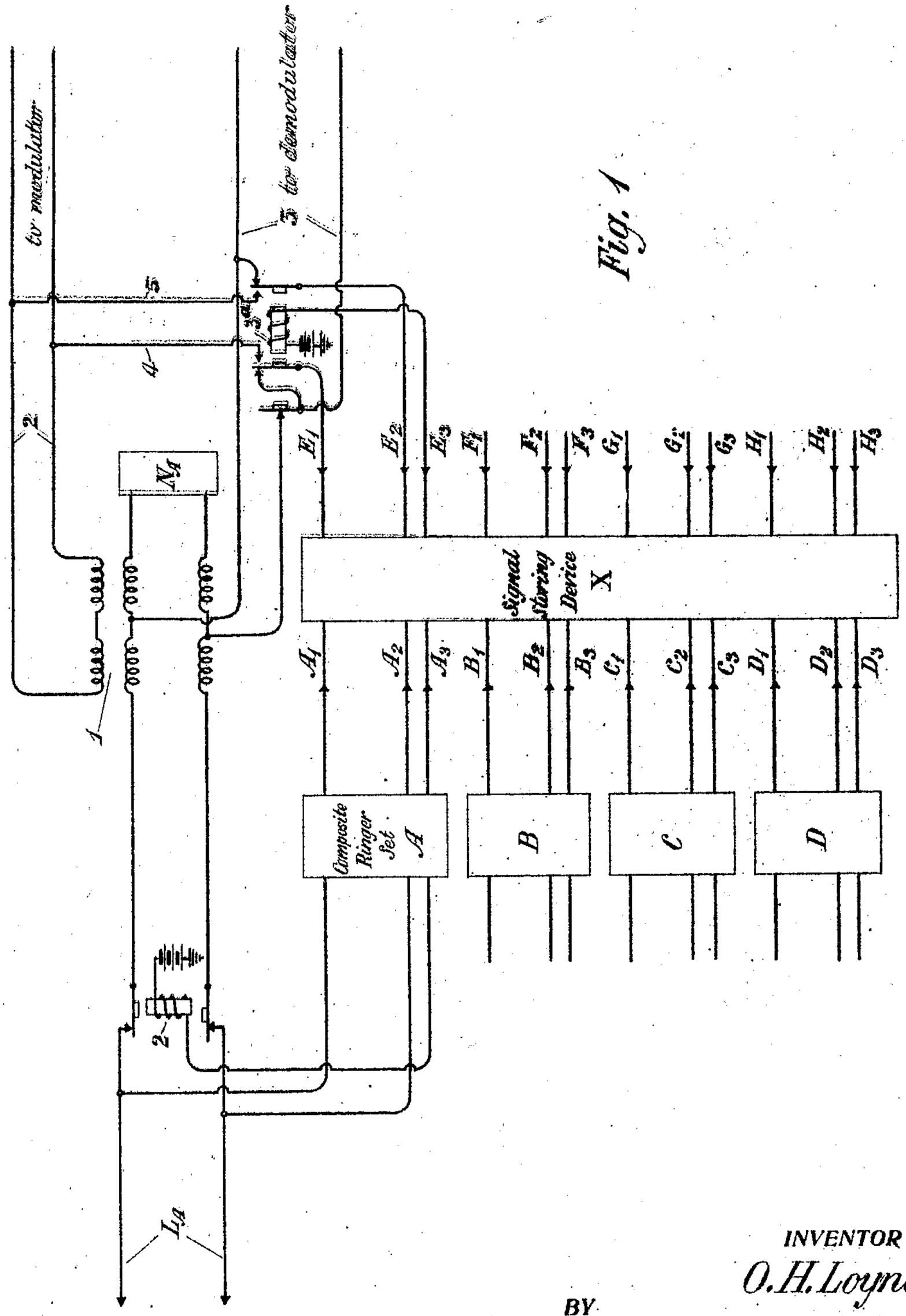

Fig. 1

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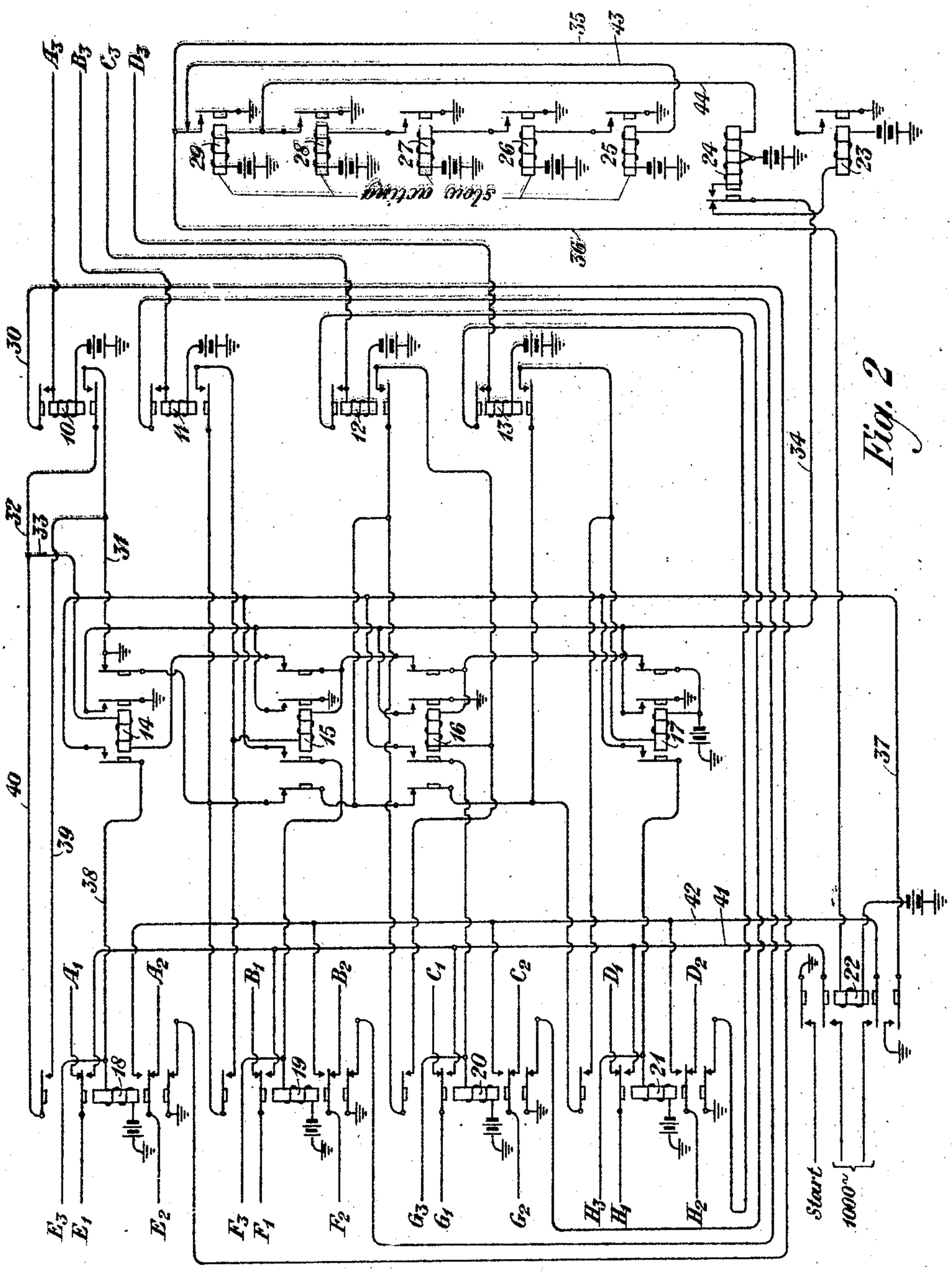

Fig. 2

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UNITED STATES PATENT OFFICE.

OWEN H. LOYNES, OF BROOKLYN, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

SIGNAL-STORING ARRANGEMENT.

Application filed May 15, 1924. Serial No. 713,572.

To all whom it may concern:

Be it known that I, OWEN H. LOYNES, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Signal-Storing Arrangements, of which the following is a specification.

This invention relates to transmission systems of the type over which a plurality of carrier frequency channels may be simultaneously transmitted and more particularly relates to improvements in signaling arrangements for such systems.

In multiplex or carrier telephony systems, it is the practice to superimpose on the various carrier channels a certain frequency for ringing or signaling purposes as well as the voice frequencies. The carrier channels, when thus modulated, are sent out simultaneously over a line to a distant station. It has been found that when similar ringing frequencies are superimposed on two of the different carrier channels simultaneously that considerable interference is apt to result therefrom when the carrier channels are transmitted out over the line. In other words, if two operators ring at the same time, even though on different carrier channels, the result is not always satisfactory. Accordingly, it is the purpose of this invention to provide a signal storing device common to a plurality of carrier channels that will automatically hold up a ringing signal until no other ringing signals are being transmitted over the carrier channels and then allow said signal to be transmitted, so that only one ringing signal may be transmitted over the channels at once and all interference may be obviated. Other features and objects of the invention will appear more fully from the detailed description hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawing in the Figures 1 and 2 of which the invention is illustrated. Fig. 1 shows a schematic diagram of a system embodying the arrangements of the invention, while in Fig. 2 are shown in detail the circuit arrangements of the signal storing device.

In Fig. 1 is shown a line L_A over which the normal telephonic currents are transmitted. Line L_A terminates in the balancing network N_A and includes the windings of a hybrid coil 1. Associated with coil 1 is a circuit 2 leading to modulator apparatus not shown. The telephonic currents from line L_A are transmitted over circuit 2 and are superimposed on a carrier channel at the modulator apparatus and are then transmitted through filtering apparatus to a common line. Associated with the midpoints of the windings of coil 1 is a circuit 3 leading to demodulator apparatus not shown. The modulated carrier channel coming in over the common line is transmitted through filtering apparatus to the demodulator, and the telephonic currents are then transmitted from circuit 3 to the line L_A. Associated with the line L_A and the circuits 2 and 3 is a ringing or signaling circuit comprising the composite ringer apparatus A, illustrated schematically, and the signal storing device X. The low frequency ringing current, herein termed 20 cycle current for purposes of illustration, would be transmitted from line L_A to the composite ringer set A where it would actuate mechanism to place a ground on lead A_3. This would start the signal storing device X in operation with respect to the signal from line L_A. As will be pointed out in detail later on, at the proper time the signal storing device X would cause a suitable ringing frequency, herein termed 1,000 cycle frequency for purposes of illustration, to be applied to the lead E_1 and E_2 and then over the contacts of relay 3^a, which operates on ground over lead E_3, to the circuit 2. This 1,000 cycle signaling frequency would then be transmitted to the modulator and superimposed on a carrier channel. The incoming ringing frequency of 1,000 cycles would be transmitted over circuit 3 from the demodulator apparatus and thence over the lead E_1 and E_2 to the signal storing device X and thence over the leads A_1 and A_2 to the composite ringer set A where they would actuate means responsive to a frequency of 1,000 cycles. These means in turn would operate the cut-off relay 2 and would cause to be applied to the line L_A a suitable ringing frequency such as 20 cycles. As the principles of the composite ringer set A are well known in the art, no further description thereof will be given.

Associated with the signal storing device X might be other composite ringer sets such

as B, C and D. These composite ringer sets would be associated with other telephone lines such as L_A. The ringing signals coming in over these telephone lines would be transmitted through these composite ringer sets to the signal storing device X. At the proper time, such as when no other ringing signals were being transmitted over the carrier channels, these ringing signals would be superimposed on the proper carrier channels and transmitted out over the common line. The ringing signals coming in over the carrier channels would in turn be transmitted from the respective demodulator circuits through the signal storing device and the composite ringer sets B, C and D to the respective telephone lines. Composite ringer set B is associated with the signal storing device X by the leads B_1, B_2 and B_3. The signal storing device X in turn will be associated with the modulator and demodulator circuits of the line with which the composite set B is associated by the leads F_1, F_2 and F_3 in a similar manner to that illustrated for the composite ringer set A. The composite ringer sets C and D are connected to their lines and respective modulator and demodulator circuits through the signal storing device X in a similar manner. With this arrangement, the signals from one line, such as L_A, will be transmitted through the composite ringer set A to the signal storing device X. If at this time no other ringing signals are being transmitted over the other carrier channels on the common line, the ringing signal from line L_A will be superimposed on the proper carrier channel for line A. However, if at this time a ringing signal from one of the other lines, such as the line associated with composite ringer set B, was being transmitted, the signal from line L_A would be automatically stored up by the signal storing device X until the termination of the other ringing signal, at which time the ringing signal from line L_A would be transmitted. With this arrangement, two ringing signals will not be sent out on the common line on their respective carrier channels at the same time, and all interference between ringing signals will in this manner be eliminated.

In Fig. 2 is shown in detail the circuit arrangements of the signal storing device X. The device X has been illustrated as an arrangement common to four carrier channels although it might be utilized for any number of channels of a system. The leads A_1, A_2, A_3, E_1, E_2, and E_3 of Fig. 1 correspond to leads similarly marked on Fig. 2. Leads marked B, C, D, F, G and H with the subscripts 1, 2, and 3 of Fig. 1 correspond to the similarly marked leads of Fig. 2. The signal storing circuit comprises four sets of relays. The relays 10, 11, 12, and 13 might be termed the storing relays as they respond to the initial ringing impulse and store the signal. The relays 14, 15, 16 and 17 might be termed the control relays. These relays are so arranged that only one of them will operate at a time. The relays of this set are controlled by the relays of the first set. The arrangement of relays 14, 15, 16 and 17 prevents two ringing impulses from being sent out at the same time. Controlled by these relays is a third set of relays 18, 19, 20, and 21 which may be termed the operating relays. These relays serve to connect the ringing source to the respective carrier channels. A fourth set of relays 25, 26, 27, 28 and 29 is provided. These relays are slow-acting relays and operate in sequence to control the time interval of the ringing. The arrangements operate in the following manner: A 20 cycle ringing impulse transmitted over the line L_A of Fig. 1 will operate the composite ringer A so that it will place a ground on the lead A_3.

Referring now to Fig. 2, the ground placed on lead A_3 will cause the relay 10 to operate. This relay will lock up in the following manner: From its upper make contact over conductor 30 to the lower back contact of relay 18 and ground. The operation of relay 10 will operate relay 14 as follows: From ground, conductor 31, lower armature and contact of relay 10, conductors 32 and 33, winding of relay 14, right-hand outer contacts of relays 15, 16 and 17 to battery and ground. The operation of relay 14 will close the circuit for relay 23 in the following manner: From ground, right-hand inner armature and contact of relay 14, conductor 34, armature and contact of relay 24, winding of relay 23 to battery and ground. This will operate relay 23 which will close the following circuit: From ground, armature and contact of relay 23, conductors 35 and 36, winding of relay 22 to battery and ground. This will operate relay 22 which will close the following circuit: From ground, lower contact and armature of relay 22, conductor 37, left-hand contact and armature of relay 14, conductor 38, winding of relay 18 to battery and ground. The closing of this circuit will operate the relay 18. The operation of relay 18, through its lower break contact, will open the previously traced circuit for relay 10 and cause said relay to release. Relay 14 will then be held operated through the upper make contact of relay 18 as follows: From ground, conductor 31, conductor 39, contact and armature of relay 18, conductors 40 and 33 and thence through the winding of relay 14 to battery as previously traced. With relays 18 and 22 operated, a 1,000 cycle ringing source will be connected over the contacts of relay 22 to conductors 41 and 42 and thence over the contacts of

relay 18 to the leads E_1 and E_2 from whence they will be applied to the modulator circuit. The 1,000 cycle ringing current will then be applied from these leads to the modulator circuit and superimposed on the carrier channel associated with line L_A for transmission out over the line. It is pointed out that a ground applied to conductor 37 at this time will operate relay 3ª. An upper make contact on relay 22 is provided to stop the 1,000 cycle oscillator or other source of supply when it is not desirable to have this furnished continuously. The 1,000 cycle ringing current coming in over the demodulator circuit 3 will be transmitted over leads E_1 and E_2 and over the back contacts of relay 18 to the leads A_1 and A_2 from whence it will be transmitted to the composite ringer apparatus A, where it will actuate mechanism to operate the line relay 2, and to apply 20 cycle ringing current to the conductors of line L_A. The duration of the ringing impulse is determined by the source of slow-acting relays 25, 26, 27, 28, and 29. The operation of relays 23, heretofore referred to, closes the following circuit: From ground, armature and contact of relay 23, conductor 35, break contact of relay 29, conductor 43, winding of relay 25 to battery and ground. This will operate the relay 25. Operation of relay 25 will in turn operate relay 26 which will in turn operate relay 27 which will in turn operate relay 28 which will in turn operate relay 29. Upon the operation of relay 28, ground will be applied from the armature and contact of said relay, over conductor 44, through the right-hand winding of relay 24 to battery and ground. This relay will lock up through its left-hand winding and the right-hand make armature of relay 14. The operation of relay 24 will release relay 23. The ground connection originally established from the armature and contact of relay 23 through the winding of relay 22 will, however, be maintained at the armature and contact of relay 29. The operation of relay 29 and the deenergization of relay 23 will cause relay 25 to release. This in turn will release relay 26 which in turn will release relay 27 which in turn will release relay 28 which in turn will release relay 29. The release of relay 29 will remove the ground from the winding of relay 22 and release relay 22. The release of relay 22 will disconnect the ringing current from the leads E_1 and E_2 and will also cause relay 18 to be released which in turn will release the relay 14 and restore the arrangements to normal. Ringing impulses coming in over any of the other leads, such as B_3, C_3, or D_3, would operate, respectively, the relays 11, 12, and 13 which would lock up over the lower contacts of relays 19, 20, and 21. Upon the release of the relay 14, one of the other relays, such as 15, 16, and 17, might be operated if a ringing signal had come in and operated one of the relays 11, 12, and 13. Accordingly upon the termination of the ringing signal coming in over lead A_3, the circuit will be in condition for the operation of a ringing signal stored up on one of the relays 11, 12, and 13. The arrangements in such instances are substantially similar to those already described. The fact that only one of the relays 14, 15, 16, and 17 can operate at a time thus prevents the simultaneous transmission of ringing signals.

While the signal storing device has been illustrated in connection with a carrier system in which the various channels are combined on a common line, it might equally well be utilized with a plurality of independent circuits.

Accordingly, while the arrangements have been disclosed as embodying a specific form which is deemed desirable, it is to be understood that they are capable of embodiment in other and widely varied forms without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A plurality of telephone lines over which voice frequencies are transmitted, means associated with each of said lines for superimposing said voice frequencies on separate carrier channels for transmission over a common circuit, signaling circuits associated with each of said lines and said last mentioned means, and a signal storing device common to all of said signaling circuits for causing the signals to be transmitted over said carrier channels at separate times.

2. A carrier system comprising a plurality of telephone lines, modulator and demodulator circuits associated with each of said lines and with a common line, signaling circuits associated with each of said telephone lines and their respective modulator and demodulator circuits, and a signal storing device common to all of said signaling circuits, said signal storing device comprising a plurality of responsive means each one individual to and responsive to the signals from different ones of said telephone lines, a plurality of controlling means each controlled by one of said responsive means and arranged so that only one will operate at a time, and a plurality of operating means each one controlled by one of said controlling means, whereby signaling current may be applied to said signaling circuits.

3. A plurality of independent signaling systems, a signal storing device common to all of said systems for storing up the incoming signals and causing the outgoing signals to be transmitted one at a time, said

signal storing device comprising a plurality of responsive means each one individual to and responsive to the signals coming in from different ones of said signaling systems, a plurality of controlling means each controlled by one of said responsive means and arranged so that only one will operate at a time, and a plurality of operating means each one controlled by one of said controlling means for transmitting outgoing signals over said systems.

4. A carrier system comprising a plurality of telephone lines, modulator and demodulator circuits associated with each of said lines and with a common line, signaling circuits associated with each of said telephone lines and their respective modulator and demodulator circuits, and a signal storing device common to all of said signaling circuits, said signal storing device comprising a plurality of responsive means each one individual to and responsive to the signals from different ones of said telephone lines, a plurality of controlling means each controlled by one of said responsive means and arranged so that only one will operate at a time, a plurality of operating means each one controlled by one of said controlling means whereby signaling current may be applied to said signaling circuits, and means for controlling the duration of application of said signaling current.

5. A plurality of independent signaling systems, a signal storing device common to all of said systems for storing up the signals coming in over said systems and causing the outgoing signals to be transmitted one at a time, said signal storing device comprising a plurality of responsive relays each one individual to and responsive to the signals coming in from different ones of said signaling systems, a plurality of controlling relays each controlled by different ones of said responsive relays and arranged so that only one will operate at a time, a source of signaling current, a signaling relay controlled by any of said control relays, a plurality of operating relays each one controlled by different ones of said control relays, and means controlled by said signaling relay and any of said operating relays for applying signaling current from said source to said signaling systems.

6. A plurality of independent signaling systems, a signal storing device common to all of said systems for storing up the signals coming in over said systems or causing the outgoing signals to be transmitted one at a time, said signal storing device comprising a plurality of responsive relays each one individual to and responsive to the signals coming in from different ones of said signaling systems, a plurality of controlling relays each controlled by different ones of said responsive relays and arranged so that only one will operate at a time, a source of signaling current, a signaling relay controlled by any of said control relays, a plurality of operating relays each one controlled by different ones of said control relays, means controlled by said signaling relay and any of said operating relays for applying signal current from said source to said signaling systems, and a chain of slow operating relays for controlling the duration of application of said signaling current and for restoring said signal storing device to normal.

In testimony whereof, I have signed my name to this specification this 14th day of May 1924.

OWEN H. LOYNES.