

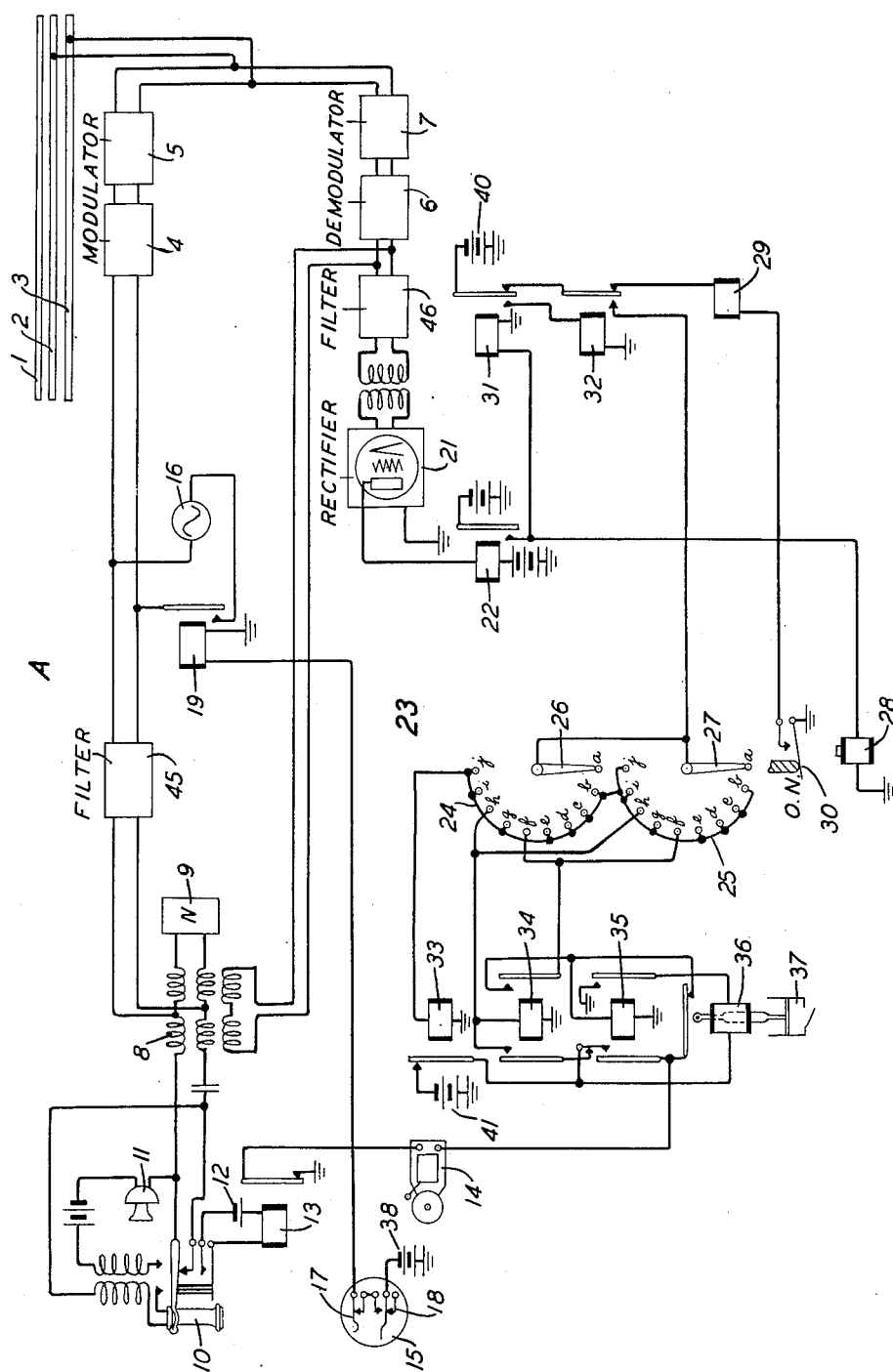
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SELECTIVE CALLING CIRCUITS

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SELECTIVE CALLING CIRCUITS

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This invention relates to transmission systems and particularly to selective calling circuits for power-line carrier-telephone systems.

One object of the invention is to provide a transmission system having a plurality of signal stations connected to a transmission line for effecting communication between stations by a carrier wave modulated by voice currents and for selectively calling a distant station by a code signal comprising the carrier wave modulated by current having a frequency within the voice frequency range that shall eliminate the current within the voice frequency range employed during selective calling from the voice currents during communication between stations.

Another object of the invention is to provide a transmission line having a plurality of signal stations connected thereto for effecting communication between stations by a carrier wave modulated by voice currents and for selectively calling a distant station by a code signal comprising the carrier wave modulated by current having a frequency within the voice frequency range that shall eliminate the current within the voice frequency range employed during selective calling from the voice currents during communication between stations and that shall pass only current of the frequency within the voice frequency range employed during selective calling to the calling circuits at the called station.

A further object of the invention is to provide a power-line having a plurality of carrier current signal stations connected thereto for communicating between stations by a carrier wave modulated by voice currents and for selectively calling a distant station by a code signal comprising the carrier wave modulated by current having a frequency within the voice frequency range that shall eliminate the current within the voice frequency range employed during selective calling from the voice currents during communication between stations and that shall pass only current of the frequency within the voice frequency range employed during se-

lective calling to the calling circuits at the called station.

In a power-line carrier-telephone system communication between signal stations is effected by carrier current modulated by voice currents. In a system of the type shown in the C. N. Nebel Patent No. 1,733,553 dated October 29, 1929, voice currents are modulated twice and one side band from the second modulation operation is transmitted over the power-line for communication purposes. In a system of the type shown in the Nebel patent it is preferable to effect selective calling between stations by a code signal of carrier current modulated with current impulses having a frequency within the voice frequency range. If a code signal of this type is used for effecting selective calling between stations, care must be taken to prevent operation of the calling apparatus during communication or talking between stations. The power-line carrier-telephone system shown in the Nebel patent is used to disclose the present invention. The code signal employed for selective calling comprises carrier current modulated with a series of groups of impulses of current having a frequency within the voice frequency range.

The system employed to disclose the invention is also shown in the application of K. O. Thorp, Serial No. 522,798 filed March 16, 1931. During selective calling an oscillator producing a frequency within the voice frequency range is intermittently connected to a transmitting channel of the type disclosed in the Nebel patent by means of a suitable telephone dial switch. The impulses of current from the oscillator having a frequency within the voice frequency range are modulated twice and one side band from the second modulation operation is transmitted over the power-lines. Code signals of this type are received by the distant called station and are demodulated by a receiving channel of the type disclosed in the above mentioned Nebel patent. The groups of impulses received from the second demodulator in the receiving channel at the called station are rectified and utilized for operating a selector switch. The selector switch employed is

preferably of the type used in automatic telephony. The selector switch after the proper code signal is received operates a calling signal which is maintained in operative position until the called operator removes his receiver from the switchhook or for a predetermined time interval.

In systems of this type provision must be made for preventing operation of the selector switch and false operation of the calling means during communication between stations. According to the present invention current having a frequency within the voice frequency range and used during selected calling is eliminated from the voice currents during communication between stations. Furthermore, means are provided for passing only current having a frequency within the voice frequency range employed for selective calling from the receiving channel to effect operation of the selector switch. By the above mentioned means the current within the voice frequency range employed during selective calling is eliminated from the voice currents during communication between stations and the voice currents used during communication between stations are eliminated from the calling circuits at the called station.

The single figure in the accompanying drawing is a diagrammatic view of a calling circuit constructed in accordance with the invention.

Referring to the drawing, a signal station A is shown connected to a power-line comprising conductors 1, 2 and 3. The power-line is assumed to carry high tension low frequency power currents. Although only one signal station is shown in the drawing it is to be understood that numerous other similar stations are connected to the power-line conductors 2 and 3. The transmitting channel at the signal station A comprises modulators 4 and 5 and the receiving channel at said station comprises demodulators 6 and 7. Although the transmitting and receiving channels are shown directly connected to the power-line conductors 2 and 3 it is to be understood that suitable coupling condensers or filters are provided for protecting the signaling apparatus and the operators against the high tension current carried by the power-lines. The transmitting and receiving channels are connected to an operator's set by means of a hybrid coil 8. A suitable balancing network 9 is associated with the hybrid coil 8. The operator's telephone set comprises a receiver 10 and a transmitter 11. The switchhook for the receiver 10 not only controls the connections of the operator's set but controls a circuit from a battery 12 to a magnet 13. The magnet 13 serves to open the circuit of a call bell 14.

A telephone dial switch 15 of a standard type is provided for connecting an oscillator 16 to the transmitting channel. The switch

effects transmission of carrier current modulated by a series of groups of impulses of current within the voice frequency range over the power-lines to selectively call a distant station. The oscillator 16 produces a current within the voice frequency range and carrier current is modulated with impulses from such oscillator by the modulators 4 and 5. One side band from the second modulator 5 is transmitted over the power-lines in the manner disclosed in the above mentioned patent to C. N. Nebel. The telephone dial switch 15 is provided with pulsing contacts 17 and off-normal contacts 18 for controlling the operation of a magnet 19 which connects the oscillator 16 across the transmitting channel.

A band elimination filter 45 is provided in the transmission channel between the hybrid coil 8 and the connection of the oscillator 16 to the transmission channel. The filter 45 serves to eliminate currents within the voice frequency range employed during selective calling from the voice currents during communication between stations. Such currents are eliminated from the voice currents during communication between stations to prevent false operation of a calling signal.

In the system under consideration it is assumed that a code signal comprising three groups of impulses is transmitted over the power-line for selectively calling a distant station. All stations are similar in construction and the receipt of a code signal comprising carrier current modulated by a series of groups of impulses of voice frequency current at a distant station will be described referring to station A.

The received groups of impulses are demodulated by the demodulators 6 and 7 and then rectified by the thermionic tube 21. In the circuit connecting the tube 21 to the receiving channel is provided a band pass filter 46 which passes only currents having the frequency of the oscillator 16. This filter serves to prevent false operation of a calling signal during communication between stations. The output from the thermionic tube 21 operates a pulsing relay 22 in accordance with the received impulses. The pulsing relay controls a selector switch 23 which in turn controls the operation of the call bell 14. The selector switch comprises two series of contact members 24 and 25 which are associated with two switch arms 26 and 27. The contact members 24 and 25 each comprise contacts *a* to *j* inclusive. The arms 26 and 27 and the contact members 24 and 25 are connected in parallel circuit relation in order to insure against any failure of operation by reason of poor contact engagement between the contact arms and the contact members. The contact arms 26 and 27 are stepped around on contact members 24 and 25 by means of a stepping magnet 28 under the control of the pulsing

relay 22. The contact arms 26 and 27 are released from any operated position by means of a releasing magnet 29 under control of off-normal contacts 30 and two slow releasing relays 31 and 32. The selector switch directly controls a clear-out relay 33 and two code relays 34 and 35 which control the circuits for operating the call bell 14. A slow operating relay 36 which is provided with a dash-pot 37 is slow operated in order to open a circuit of the call bell 14 a predetermined time after the closing thereof.

Communication between the stations in the system disclosed in the drawing is assumed to be effected in the same manner as in the system disclosed in the above mentioned patent to C. N. Nebel. Accordingly, it is deemed unnecessary to describe in detail the manner in which communication between stations is effected.

When the operator at one station desires to call the operator at a distant station the switch 15 is dialed in accordance with the code signal required to call the distant station. The operation of the dial switch 15 intermittently opens and closes the pulsing contacts 17 to complete a circuit from a battery 38 through the relay 19. This circuit, it may be noted, is completed through the off-normal contacts 18. The relay 19 connects the oscillator 16 to the transmitting channel in accordance with the code signal required to call the distant station. The code signal supplied to the transmitting channel comprises three groups of impulses of current having a frequency within the voice frequency range. Carrier current is modulated by the code signal of impulses from the oscillator 16 and transmitted over the power-line to the distant called station.

At the distant station the code signal of modulated impulses is demodulated and rectified for operating the pulsing relay 22 directly in accordance with the code signal. It is assumed that the code signal for operating the selector at the disclosed station comprises one group of nine impulses, a second group of seven impulses and a third group of five impulses. The first group of nine impulses steps the contact arms 26 and 27 into engagement with the contact members *j*. The slow releasing relays 31 and 32 are held in operative position until after the first group of impulses have been received. The relay 31 is first operated to complete a circuit from the battery 40 for operating the second slow releasing relay 32. After receipt of the first group of impulses the slow releasing relay 31 releases to open the circuit of the second slow releasing relay 32. The relay 31 also completes a circuit from the battery 40 through its armature and the armature of the second slow releasing relay 32, switch arms 26 and 27 and contact members *j* in parallel to the operating coil of clear-out re-

lay 33. The relay 33 is operated to insure that the relay chain is returned to normal position. It is necessary to return the relay chain to normal position in case any code relay has been previously operated by talking operation or by a false dial operation. The relay 33 when operated insures the breaking of the circuit of the relays 34, 35 and 36 from the battery 41. Upon release of the second slow releasing relay 32 a circuit is completed from the battery 40 through the armatures of the relays 31 and 32, releasing magnet 29 and the off-normal contacts 30 to ground return. The release of relay 32 also removes the battery connection to switch arms 26 and 27 before they leave contact members *j*. This releases relay 33. The releasing magnet 29 is operated to return the switch arms 26 and 27 to initial position.

The second group of impulses comprising the code signal steps the switch arms 26 and 27 into engagement with the contact members *h*. Upon release of the relay 31 a circuit is completed from the battery 40 through the armatures of the relays 31 and 32, switch arms 26 and 27 and contact members *h* in parallel, operating coil of relay 34 and ground return to the battery 40. The relay 34 is provided with two switch arms, one of which closes a locking circuit for the relay through a normally closed contact on relay 35 from the battery 41 and the other switch arm serves to prepare a circuit for operating the code relay 35 when the next group of impulses are received. The switch arms 26 and 27 are returned to initial position by the slow releasing relays 31 and 32 and the release magnet 29 in the same manner as described when considering the first group of received impulses.

Upon receipt of the third group of impulses the switch arms 26 and 27 are moved into engagement with the contact members *f*. The release of relay 31 completes a circuit from the battery 40 through the armatures of the relays 31 and 32, switch arms 26 and 27 and contact members *f* in parallel, armature of relay 34, operating coil of code relay 35 and ground return to the battery 40. The relay 35 is provided with two armatures, one of which completes a circuit from the battery 41 for operating the call bell 14, and a holding circuit for relay 35 from battery 41 through a normally closed contact on relay 36. The other armature of the relay 35 completes a circuit from the battery 41 through the coil of the dash-pot relay 36. After the bell has been operated for a predetermined time the dash-pot relay 36 opens the holding circuit for the relay 35, which in turn opens the circuit of the call bell 14. The operation of the call bell may also be stopped by removal of the receiver 10 from the switchhook. The switchhook upon the removal of the receiver therefrom completes a circuit for operating

the relay 13, which in turn opens the operating circuit for the call bell 14.

The slow releasing relays 31 and 32 in combination with the release magnet 29 return the switch arms of the selector switch 23 to initial position in the manner described above when reference was made to the receipt of the first group of calling impulses.

The contact members *i*, *g*, *e*, *d*, *c* and *b* of the selector switch 23 are connected to the contact member *j* and the clear-out relay 33 so as to operate the clear-out relay in case of a false operation of the selector switch. If the dial switch should be falsely operated and the selector switch operated or the selector switch be operated during conversation between stations, no signal will be sounded unless the code signal for the station is received. The clear-out relay 33 will be operated when the switch arms 26 and 27 are moved from normal position except when moved into engagement with the contact members *h* and *f*.

Modifications in the system and in the arrangement and location of parts may be made within the spirit and scope of the invention. Such modifications are intended to be covered by the appended claims.

What is claimed is:

1. In a signaling system, a transmission line, a plurality of signal stations connected to said line, means for communicating between stations by carrier current modulated by voice frequency currents, means at a station for selectively calling another station by carrier current modulated by impulses of current having a frequency within the voice frequency range, and means at the transmitting station for eliminating current of the frequency within the voice frequency range employed for calling purposes from the voice currents during communication between stations.

2. In a signaling system, a transmission line, a plurality of signal stations connected to said line, means for communicating between stations by carrier current modulated by voice frequency currents, means for selectively calling another station by carrier current modulated by impulses of current having a frequency within the voice frequency range, means comprising a filter at the transmitting station for eliminating current of the frequency within the voice frequency range employed for calling purposes from the voice currents during communication between stations, and means comprising a filter at the called station for passing only current of frequency within the voice frequency range employed for calling to the call receiving circuit at a called station.

3. In a power-line carrier-telephone system, a power-line carrying high tension low frequency current, a plurality of signal stations connected thereto, means for communicating between stations by carrier current

modulated by voice currents, means for effecting selective calling between stations by carrier current modulated with current having a frequency within the voice frequency range, and means for eliminating the current within the voice frequency range employed during selective calling from the voice currents during communication between stations and for eliminating all voice frequency current except the voice frequency current employed for selective calling from the call receiving circuit at a called station.

4. In a power-line carrier-telephone system, a power-line having a plurality of signal stations connected thereto, means for communicating between stations by carrier current modulated by voice frequency currents, means at a station for selectively calling another station by carrier current modulated by impulses of current having a frequency within the voice frequency range, and means at the transmitting station for eliminating current of the frequency within the voice frequency range employed for calling purposes from the voice currents during communication between stations.

5. In a power-line carrier-telephone system, a power-line having a plurality of signal stations connected thereto, means for communicating between stations by carrier current modulated by voice frequency currents, means for selectively calling another station by carrier current modulated by impulses of current having a frequency within the voice frequency range, means comprising a filter at the transmitting station for eliminating current of the frequency within the voice frequency range employed for calling purposes from the voice currents during communication between stations, and means comprising a filter at the called station for passing only current of frequency within the voice frequency range employed for calling to the call receiving circuits.

6. In a power-line carrier-telephone system, a power-line, a plurality of signal stations connected thereto, means for communicating in opposite directions between stations by one carrier wave modulated by voice frequency currents, means for effecting selective calling between stations by the same carrier wave employed during communication between stations and modulated by a code signal of impulses of current having a frequency within the voice frequency range, and means for eliminating the current within the voice frequency range employed during calling from the voice currents during communication between stations.

7. In a power-line carrier-telephone system, a power-line, a plurality of signal stations connected thereto, means for communicating in opposite directions between stations by one carrier wave modulated by voice

frequency currents, means for effecting selective calling between stations by the same carrier wave employed during communication between stations and modulated by a code signal of impulses of current having a frequency within the voice frequency range, means for eliminating the current within the voice frequency range employed during calling from the voice currents during communication between stations, and means at the called stations for eliminating all voice frequency currents except the voice frequency current employed for selective calling from the call receiving circuits.

8. In a power-line carrier-telephone system, a power-line carrying high tension low frequency current, a plurality of signal stations connected thereto, means for transmitting carrier current modulated by voice currents for communication between stations, means at a station comprising a telephone dial switch for transmitting a code signal of carrier current modulated by a series of groups of impulses of current having a frequency within the voice frequency range over the power-line to selectively call a distant station, a telephone selector switch at the called station, means for demodulating the modulated calling current at the called station and for operating said selector by the demodulated calling signal, and means for eliminating the current within the voice frequency range employed during selective calling from the voice currents during communication between stations.

9. In a power-line carrier-telephone system, a power-line carrying high tension low frequency current, a plurality of signal stations connected to said power-line, means for communicating between stations by carrier current modulated with voice frequency current, means at a station for transmitting a code signal of carrier current modulated by a series of groups of impulses of current having a frequency within the voice frequency range over the power-line to selectively call a distant station, means for eliminating the current within the voice frequency range employed during selective calling from the voice currents during communication between stations, a telephone selector switch at the called station, means at the called station to demodulate the received calling signal for operating said selector, and means at the called station for eliminating all voice frequency currents except the voice frequency current employed for selective calling from the circuits for operating the selector.

10. In a communication system, a transmission line having signal stations connected

thereto, calling selector switches at said stations, means at the signal stations employing currents within the voice frequency range for communicating purposes, means employing a current having a frequency within the voice frequency range for operating a selector switch at a distant station and means for preventing transmission over said line during communication, the current of the frequency within the voice frequency range employed when calling a distant station to prevent operation of the selector switches.

11. In a communication system, a transmission line having a plurality of signal stations connected thereto, calling selector switches at said stations, means at the stations employing currents having frequencies within the voice frequency range for communication purposes, means at said stations employing current having a frequency within the frequency range of the currents employed during communication for operating a selector switch at a distant station, and means for eliminating from said line during communication currents having a frequency of the current employed during calling to prevent operation of the selector switches.

12. In a communication system, a transmission line having a plurality of signal stations connected thereto, calling selector switches at said stations, means employing voice frequency currents for communication between stations in opposite directions over said transmission line, means at each of said stations employing code signals of current having a frequency within the voice frequency range for selectively calling another station, means for eliminating from said line during communication currents having a frequency of the current employed during calling, and means at a called station during calling for eliminating from the calling circuits all voice frequency currents except the code signals of voice frequency current employed for calling purposes.

13. A communication system comprising a line, stations connected thereto, calling selector switches at said stations, a portion of said line comprising a circuit over which voice frequency currents are transmitted in both directions for telephoning between stations, means for selectively calling any of said stations by use of code signals of current having a frequency within the voice frequency range and means for eliminating from the transmission line current of the frequency within the voice frequency range employed during calling to prevent operation of the selector switches during communication between stations.

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