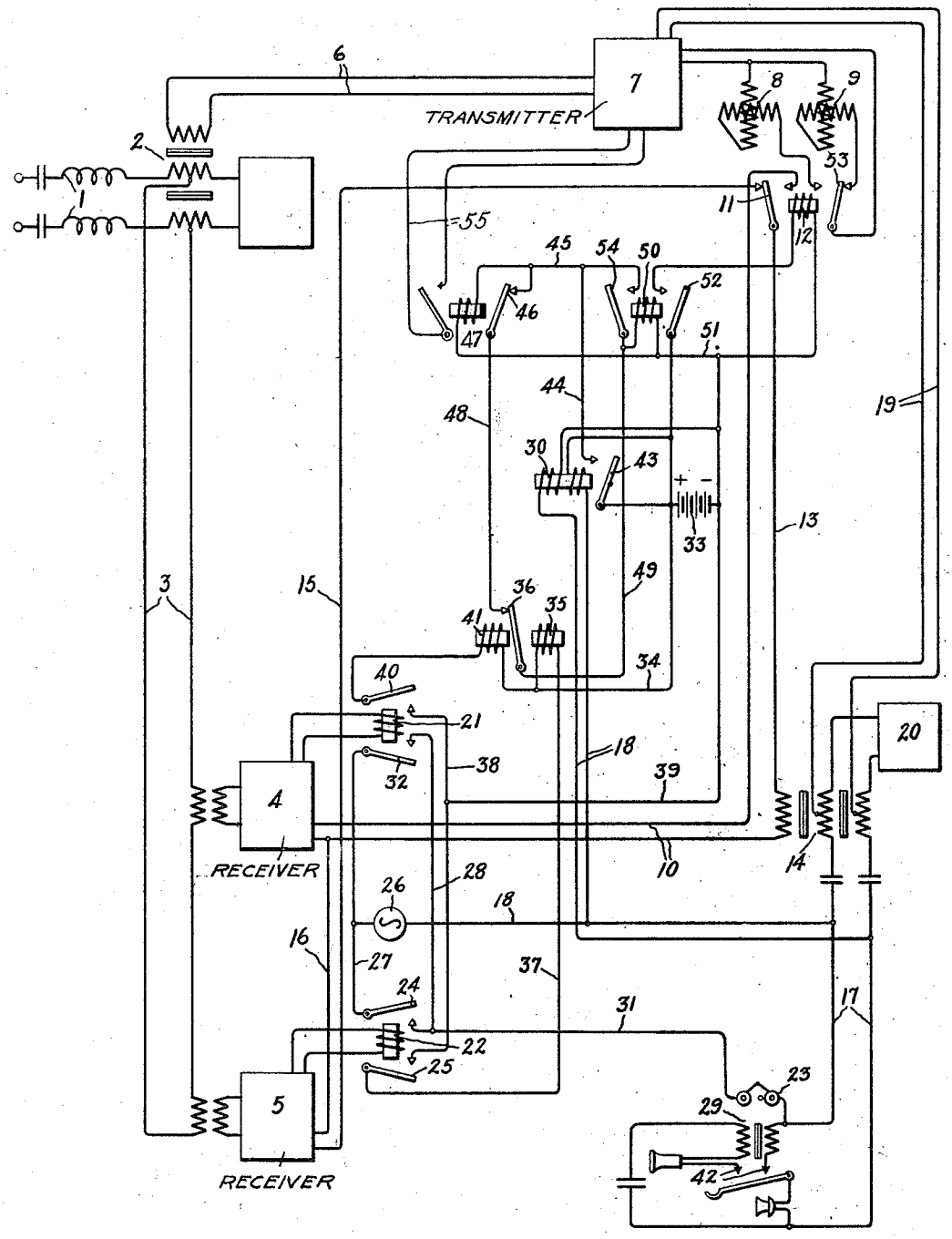
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HIGH FREQUENCY COMMUNICATION SYSTEM

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HIGH-FREQUENCY COMMUNICATION SYSTEM

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My invention relates to high frequency communication systems and more particularly to systems in which communication is effected by means of carrier currents transmitted over wire line conductors such as those employed in the usual power distribution system. My invention further relates to communication systems which are adapted for duplex operation and while I shall describe it with particular reference to systems in which the duplex operation is effected on a single frequency it will, of course, be understood that it is not limited thereto, since different frequencies may be employed for communication in the different directions.

In communication systems of the type indicated the present practice is to employ one frequency for communication between points situated on the power distribution system and a second and different frequency for communication between points on the distribution system and points on a second distribution system which is also provided with carrier current equipment. The former of these frequencies is usually denoted as the system frequency and the latter as the intersystem frequency.

One purpose of my invention is to provide means whereby when a call is received at a particular station the operator by removing his telephone receiver from the hook will automatically establish the proper connections upon his transmitter and receiver for operation at the calling frequency. A further purpose of my invention is to provide in such a system means whereby subsequent calls received and indicated at the operator's station before the telephone receiver has been returned to the hook and on the opposite frequency, will not interfere with the prior connections. A further purpose is to provide means whereby the operator by merely operating his receiver hook can discontinue his prior conversation and talk on the other frequency in response to a subsequent call on that frequency. A further purpose of my invention is to efficiently accomplish the above result with a minimum of equipment and without annoyance to the operator.

The novel features which I believe to be characteristic of my invention will be set out in the appended claims. My invention itself, however, both as to its organization and method of operation will best be understood by reference to the following description taken in connection with the accompanying drawing in which is shown a communication system of the duplex type to which my invention has been applied.

Referring to the drawing 1 represents a line extending through coupling condensers to the usual wire line circuit or power distribution system, 2 represents a transformer of the usual hybrid coil type by means of which the line 1 is connected through conductors 3 to receivers 4 and 5 and also through conductors 6 to a transmitter 7. In the particular case illustrated I have shown a system in which two receivers are employed, one for operation at the system frequency and the other for operation at the intersystem frequency, and one transmitter which is adapted by means of the variometers 8 and 9 to operate at either of these frequencies. The output circuit of the receiver 4 is connected through conductors 10, right-hand stationary contact and movable contact 11 of the relay 12 and conductor 13 to the primary winding of the transformer 14. Likewise the output circuit of the receiver 5 is connected to the primary winding of the transformer 14 through a circuit including the conductor 15, left-hand stationary contact and movable contact 11 of the relay 12, conductor 13, primary winding of the transformer 14, lower conductor 10 and conductor 16. The transformer 14 is the usual hybrid coil which is connected through conductors 17 to the operator's station and through conductors 19 to the input circuit of the transmitter 7 and which is also provided with the usual balancing network 20.

Each of the receivers 4 and 5 are provided with selector switches which operate responsively to received code impulses corresponding to the particular operator's station 29 to operate the relays 21 and 22 which in turn operate to energize the indicating device 23 at the operator's station. For example, if a call is received on the intersys-

tem frequency to which the receiver 4 is adapted to respond, the relay 21 will be energized closing its contacts 32 and 40. By means of the contacts 32 a circuit will be completed from one side of the source of potential 26 through conductor 27, contacts 32, conductors 28 and 31, indicating device 23, left-hand conductor 17 and conductor 18 to the other side of the source 26. It will be noted that the contacts 24 of the relay 22 and contact 32 of the relay 21 are connected in multiple so that closing of either of these contacts will energize the same signaling circuit and the indicating device 23 at the operator's station.

In accordance with my invention I provide means which are responsive to the frequency upon which the call is received, means which are responsive to the position of the receiver hook at the operator's station and an additional means which is jointly responsive to the operation of the above mentioned two means for adjusting the transmitter connection. The first of these means comprises the position relay 36 having two actuating coils 41 and 35 the former of which is energized in response to closing of contacts 40 on relay 21 as in response to a call received on intersystem frequency; and the latter of which is energized in response to closing of contacts 25 of relay 22 as in response to a call received on system frequency. Upon energization of coil 35 the armature is moved to the right or circuit opening position in which position it remains until the coil 41 is energized to move it to the left or circuit closing position.

The second means comprises the relay 30 which operates responsively to closing of contacts 42 as in response to lifting of the receiver from the receiver hook by the operator. This relay is provided with contacts 43 which are in circuit with the actuating coil of the relay 50, contacts of relay 36 and contacts 46 of an additional relay 47. The relay 50 comprises means which when energized actuates the relay 12 to effect the desired circuit connections.

My invention may best be understood by reference to its operation. When the relay 21 is energized as in response to a call on intersystem frequency, by means of its contacts 40 a circuit is closed leading from the positive side of the source of potential 33 through conductor 34, coil 41 of the relay 36, contacts 40, conductor 38 and conductor 39 to the opposite side of the source of potential 33, thereby energizing coil 41 and actuating the armature of relay 36 to its circuit closing position.

When the operator removes his receiver from the hook responsively to the call which has been indicated by the device 23 a circuit will be closed at the points 42 on the receiver hook thereby energizing the circuit leading from the operator's station 29 through the conductors 17, conductors 18, energizing coils of the relay 30, conductors 34 and 39 to the source of potential 33. The armature of relay 30 will then be actuated closing the contacts 43. The latter close a circuit leading from the positive side of the source of potential 33 through the contacts 43 of relay 30, conductor 44, conductor 45, normally closed contacts 46 of relay 47, conductor 48 stationary contact and armature of relay 36, conductor 49, actuating coil of the relay 50, conductor 51 and conductor 39 to the negative side of the source of potential. This circuit and hence the relay 50 will only be energized when the armature of the relay 36 is in the position shown in the drawing, as in response to a call received through the receiver 4. If the call was received through the receiver 5 the armature of the relay 36 will have been operated to the right or circuit opening position thereby rendering the relay 50 inoperative. An additional circuit is closed in response to relay 30 leading from the positive side of the source of potential 33 through the contacts 43 of the relay 30, conductor 44, conductor 45, actuating coil of the relay 47, conductor 51 and conductor 39 to the negative side of the source of potential. The relay 47 is adapted by its left hand contacts, to close the energizing circuit 55 of the transmitter 7. It will be noted that its contacts 46 are included in the energizing circuit of the actuating coil of the relay 50. It is slightly slow acting, however, such that the contacts 46 will not separate until the armature of the relay 50 has been actuated. Upon energization of the relay 50 its contacts 54 close to establish a circuit leading from the positive side of the source of potential 33, through contacts 43 of the relay 30, conductor 44, conductor 45, contacts 54 and energizing coil of the relay 50, conductor 51, and conductor 39 to the negative side of the source of potential. This circuit constitutes a holding circuit for the relay 50 retaining it in its actuated position until deenergized in response to deenergization of the relay 30 when the receiver has been placed upon the hook at the operating station. Consequently if a subsequent call be received on system frequency moving the armature of relay 36 to the right it has no effect on relay 50. By means of the contacts 52 of the relay 50 a circuit is closed leading from the positive side of the source of potential 33 through the conductor 34, contacts 52 of the relay 50, actuating coil of the relay 12, conductors 51 and 39 back to the negative side of the source of potential. The armature 53 of relay 12 is biased to the position shown in the drawing thereby connecting the variometer 9 into the oscillatory circuit of the transmitter thereby normally adapting the transmitter for operation at system frequency. Upon energization of the actuating coil of the relay 12, the armature 53 is moved against its left-hand stationary contact thereby breaking the circuit of the variometer 9 and connecting the variometer 8 into the oscillatory circuit of the

transmitter thereby connecting the transmitter to operate at intersystem frequency. Likewise by means of its movable contact 11 which is actuated to the right the output circuit of the receiver 4 is connected to the primary winding of the transformer 14.

When the operator replaces the telephone receiver on the hook at the operator's station the energizing circuit of the relay 30 is broken at the contacts 42, thereby causing its contacts 43 to separate and deenergize relays 50, 47 and consequently 12 which returns the transmitter to its normal connection.

If a call be received on system frequency the relay 22 will be energized closing its contacts 25 energizing the coil 35 of relay 36 and causing the armature of relay 36 to move to the right or circuit opening position. The operator then removes the telephone receiver from the hook energizing the relay 30 through the circuit previously traced which in turn closes its contacts 43. Due to the fact that the armature of relay 36 is now in the circuit opening position the relay 50 will not be energized and in consequence the transmitter connections will not be changed. The relay 47 however will be energized as before and after a time interval opens its contacts 46. Consequently if before the telephone receiver is replaced on the hook, a call is received on intersystem frequency the closing of the contacts of relay 36 will have no effect and the previously established connections will be unaltered. The operator, desiring to answer the subsequent call may replace his receiver on the hook and immediately remove it and speak on the calling frequency.

It will thus be seen that by my device the transmitter and receiver connections are adjusted in response to the frequency of the received call and when adjusted they will not be effected by subsequent calls until the prior call is completed as indicated by replacing the receiver on the hook. At that time the operator may immediately respond to the subsequent call.

While I have shown and described the preferred embodiment of my invention it will be apparent that my invention is not limited to the particular embodiment shown but that many modifications in the circuit arrangements and instrumentalities employed in carrying out my invention may be made without departing from the scope thereof as set forth in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a transmitting system, a receiving system, an operator's station associated with said systems and adapted to be called on any of a plurality of frequencies and means whereby said transmitting system and said receiving system are each automatically connected to operate at a frequency corresponding to the calling frequency in response to a non-selective operation of the called party.

2. In combination, a transmitting system, a receiving system, an operator's station associated with said systems and adapted to be called on any of a plurality of frequencies and means jointly responsive to the position of the receiver hook in said operator's station and to the calling frequency for connecting said transmitting system and said receiving system to operate at a frequency corresponding to the calling frequency.

3. In combination, a transmitting system, a receiving system, an operator's station associated with said systems and adapted to be called on any of a plurality of frequencies, means jointly responsive to the position of the receiver hook in said operator's station and to the calling frequency for connecting said transmitting system and said receiving system to operate at a frequency corresponding to the calling frequency and means for retaining said connections until said receiver hook is replaced in position.

4. In a signaling system adapted for single frequency duplex operation at either of two frequencies, an operator's station adapted to be called on either of said frequencies, means normally connecting said system for operation at one of said frequencies and operable responsively to the position of the receiver hook in said operator's station to connect said system for operation at said other frequency and means responsive to the calling frequency for rendering said last means inoperative when said calling frequency is the frequency at which said signaling system is normally connected to operate.

5. In a signaling system adapted for single frequency duplex operation at either of two frequencies, an operator's station adapted to be called on either of said frequencies, means normally connecting said system for operation at one of said frequencies and operable responsively to the position of the receiver hook in said operator's station to connect said system for operation at said other frequency, means for retaining said connecting means in its operated condition until said receiver hook is replaced and means responsive to the calling frequency for rendering said connecting means inoperative when said calling frequency is the frequency at which said signaling system is normally connected to operate.

6. In a signaling system adapted for single frequency duplex operation at either of two frequencies, an operator's station adapted to be called on either of said frequencies, means normally connecting said system for operation at one of said frequencies and adapted when actuated to connect said system for operation at the other frequency, means operable responsively to the calling frequency, means operable responsively to the position of

the receiver hook in said operator's station, an actuating circuit for said connecting means adapted to be energized responsively to said last two means, means for retaining said connecting means in its actuated position and means for opening said actuating circuit after a time interval after said connecting means has been actuated.

7. In a high frequency signaling system, a transmitter normally connected to operate at one frequency and adapted to be connected to operate at a second frequency, a receiver normally connected to operate at a frequency corresponding to the frequency at which said transmitter is normally connected to operate, a second receiver, adapted to be connected to operate at a frequency corresponding to said second frequency, an operator's station adapted to be called on either of said two receiver frequencies, means whereby said transmitter and said receivers are connected for operation at the frequency corresponding to the calling frequency, said means including means responsive to the position of the receiver hook in said operator's station for changing said transmitter and receiver connections and means responsive to the calling frequency for rendering said last means ineffective when said calling frequency corresponds to the frequency at which said transmitter is normally connected to operate.

8. In a high frequency signaling system, a transmitter normally connected to operate at one frequency and adapted to be connected to operate at a second frequency, a receiver normally connected to operate at a frequency corresponding to the frequency at which said transmitter is normally connected to operate, a second receiver, adapted to be connected to operate at a frequency corresponding to said second frequency, an operator's station adapted to be called on either of said two receiver frequencies, means whereby said transmitter and said receivers are connected for operation at the frequency corresponding to the calling frequency, said means including means responsive to the position of the receiver hook in said operator's station for changing said transmitter and receiver connection, means for retaining said connection changing means in its changed condition until the receiver hook is replaced and means responsive to the calling frequency for rendering said connection changing means ineffective when said calling frequency corresponds to the frequency at which said transmitter and receiver are normally connected to operate.

9. In a high frequency signaling system, a transmitter normally connected to operate at one frequency and adapted to be connected to operate at a second frequency, a receiver normally connected to operate at a frequency corresponding to the frequency at which said transmitter is normally connected to operate, a second receiver, adapted to be connected to operate at a frequency corresponding to said second frequency, an operator's station adapted to be called on either of said two receiver frequencies, means whereby said transmitter and said receivers are connected for operation at the frequency corresponding to the calling frequency, said means including means responsive to the position of the receiver hook in said operator's station, means operable responsively to said first means and adapted to change said transmitter and receiver connections, means for retaining said connections in their changed condition until said receiver hook is replaced, and means responsive to the calling frequency for rendering said circuit changing means ineffective when said calling frequency corresponds to the frequency at which said transmitter and receiver is normally connected to operate.

10. In a high frequency signaling system, a transmitter normally connected to operate at one frequency and adapted to be connected to operate at a second frequency, a receiver normally connected to operate at a frequency corresponding to the frequency at which said transmitter is normally connected to operate, a second receiver adapted to be connected to operate at a frequency corresponding to said second frequency, an operator's station adapted to be called on either of said two frequencies, means whereby said transmitter and said receivers are connected for operation at the frequency corresponding to the frequency on which said operator's station has been called, said means including means responsive to the position of the receiver hook in said operator's station, a relay adapted when operated to change said transmitter and receiver connection, means operable responsively to the calling frequency, a circuit adapted to energize said relay responsively to operation of said two means, a holding circuit for said relay and means for opening said energizing circuit after a time interval after said first mentioned means has been actuated.

11. In combination, a transmitter adapted for operation at any of a plurality of frequencies, an operator's station, signaling means in said station connected to respond to received current of any of a plurality of frequencies, and means responsive to a non-selective operation of the operator for connecting said transmitter to operate at a frequency determined by the frequency of the received current.

12. In combination, a transmitter adapted for operation at any of a plurality of frequencies, an operator's station, signaling means in said station connected to respond to received current of any of a plurality of frequencies, means responsive to a non-selective operation of the operator for connecting said transmitter to operate at a frequency

determined by the frequency of the received current and means for retaining the transmitter connections independently of subsequently received current of different frequency.

13. In combination, a transmitter normally connected to operate at a certain frequency, means responsive to a non-selective operation of the operator for connecting said transmitter to operate at a different frequency, receiving means normally connected to respond to either of two frequencies, and means for rendering said first means inoperative dependent upon the frequency of current received by said receiving means.

14. In combination, a transmitter normally connected to operate at a certain frequency, means responsive to a non-selective operation of the operator for connecting said transmitter to operate at a different frequency, receiving means responsive to either of two frequencies, means responsive to one of said last mentioned frequencies for rendering said first means inoperative and responsive to the other of said frequencies for rendering said first means operative, and means for maintaining the transmitter connections independently of operation of said last means subsequent to making of the connections.

15. In combination, a station, a transmitter in said station normally connected to operate at a certain frequency, signal means in said station responsive to either of two frequencies upon which said station may be called, a switch having a normal position and an off-normal position, means responsive to operation of said switch to one position for connecting said transmitter to operate at a different frequency, means for rendering said last means inoperative when the station is called on one of said frequencies and operative when called on the other frequency, and means for maintaining the transmitter connections after said switch is operated to said off-normal position and until it is restored to normal position.

In witness whereof, I have hereunto set my hand this 17th day of May, 1927.

STANLEY A. CLARK.