

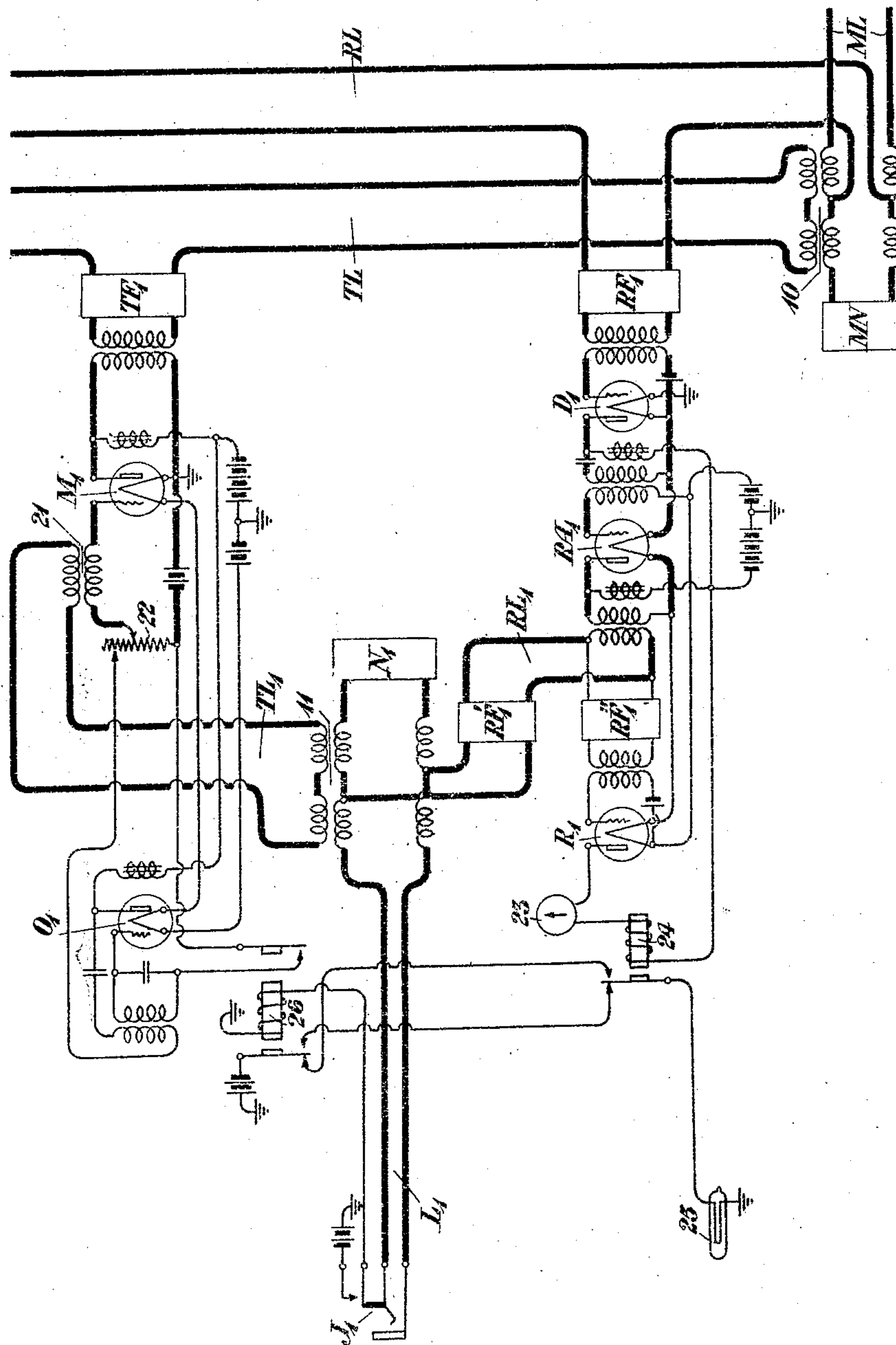
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H. A. AFFEL

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SUPERVISORY CIRCUITS FOR MULTIPLEX SIGNALING

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Inventor
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By his Attorney

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UNITED STATES PATENT OFFICE.

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SUPERVISORY CIRCUITS FOR MULTIPLEX SIGNALING.

Application filed December 31, 1920. Serial No. 434,225.

To all whom it may concern:

Be it known that I, HERMAN A. AFFEL, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Supervisory Circuits for Multiplex Signaling, of which the following is a specification.

This invention relates to the transmission of signals, and more particularly to the transmission of signals by means of so-called carrier currents.

One of the objects of the present invention is to provide arrangements whereby supervisory signals may be transmitted over a toll line employing carrier currents for transmission purposes.

Other objects of the invention will appear more fully from the following description when read in connection with the accompanying drawing, the figure of which is a circuit diagram illustrating one embodiment of the invention.

Referring to the drawing, L_1 designates a low frequency telephone line associated through a balanced transformer 11 with a transmitting channel TL_1 and a receiving channel RL_1 of the carrier system. The line L_1 is balanced by an artificial line or network N_1 , in order to render the circuits TL_1 and RL_1 substantially conjugate. The channel TL_1 leads through a transformer 21 to the input circuit of a modulator M_1 of the well-known vacuum tube type. The modulator M_1 is also supplied with oscillations generated by a vacuum tube oscillator O_1 and transmitted to the modulator through a potentiometer 22. The output circuit of the modulator M_1 is connected to a common transmitting circuit TL through a band filter TF_1 , it being understood that other transmitting channels may be similarly associated with the common circuit TL .

The receiving channel RL_1 includes a detector D_1 of well-known vacuum tube type, in the output circuit of which a vacuum tube amplifier RA_1 may be included. The outgoing circuit from the amplifier RA_1 is divided in two branches, one branch being connected to the midpoints of the windings of the balanced transformer 11 through a low pass filter RF'_1 , which is designed to transmit frequencies within the voice range, but to suppress higher frequencies. The other branch includes a high pass filter

RF''_1 adapted to pass carrier frequencies but suppress voice frequencies. The branch including the filter RF''_1 also includes a rectifying tube R_1 of well-known type, in the output circuit of which is a milliammeter 23 for indicating the amplitude of the rectified current and a relay 24 for controlling a supervisory lamp 25. The receiving channel is connected through a band filter RF_1 to the common receiving circuit RL , it being understood that other receiving channels are similarly associated with the circuit RL . The common circuits TL and RL are connected with the line ML through a balanced transformer arrangement 10, and an artificial line or network MN is provided for balancing the main transmission line ML , thereby rendering the circuits TL and RL substantially conjugate. The line L_1 terminates in a jack J_1 whereby connections may be established to any desired low frequency line. The jack J_1 is so arranged that when a plug is inserted therein in establishing a connection with the low frequency line a relay 26 will be operated. The relay 26 controls the supervisory lamp 25 jointly with the relay 24. Relay 26 also controls the circuit of the oscillator O_1 to render the same operative or inoperative.

Further details of the apparatus will be understood from a description of the operation, which is as follows: An operator desiring to establish a connection over the carrier channels above described will insert the plug of a toll cord in the jack J_1 to connect a low frequency line to the line L_1 . A circuit is then completed over the upper springs of the jack J_1 through the windings of the relay 26, which, upon being energized, closes at its left hand front contact a circuit from battery over the left hand back contact of the relay 24 through the lamp 25, which is thereby caused to glow. Relay 26 at its right hand front contact completes the circuit of the oscillator O_1 , thereby causing the carrier frequency to be generated and transmitted through the modulator M_1 through the filter TF_1 and over the circuit TL to the line ML , over which it is transmitted to the distant station. The supplying of the carrier frequency to the line places the circuit in condition for conversation in one direction.

The carrier frequency thus transmitted to the distant station actuates a supervisory

lamp at said station similar to the lamp 25 to call the attention of the operator at said station. The operations taking place at the distant station in connection with the lighting of this lamp may be understood from a consideration of the similar operations taking place at the station illustrated. Assuming that the line L_1 is idle and that the operator at the distant station has inserted the plug in the jack at that station and transmitted the carrier frequency corresponding to the receiving channel RL_1 over the main line ML , said carrier frequency will flow into the common receiving circuit RL and be selected through the filter RF_1 . The carrier frequency then passes through the detector D_1 and the amplifier RA_1 to the branch including the filter RF''_1 . The filter RF''_1 being a low pass filter prevents the transmission of the carrier frequency through the branch leading to the line L_1 . The carrier frequency being transmitted through the filter RF''_1 is rectified by the rectifier R_1 , thereby causing an indication of the ammeter 23, and also causing the relay 24 to be energized. Remembering that under the conditions assumed the relay 26 is not energized, it will be apparent that when relay 24 pulls up its armature the supervisory lamp 25 is caused to glow by a circuit completed over the back left hand contact of the relay 26 and the front contact of relay 24.

The glowing of this lamp apprises the operator at the station illustrated that a call is awaiting, whereupon the operator inserts a plug into the jack J_1 to answer the call. This operation completes a circuit for the relay 26, which, at its left hand contact, opens the circuit previously established for the lamp 25, thereby extinguishing the lamp at its right hand front contact. Relay 26 completes the circuit of the oscillator O_1 and transmits the carrier frequency assigned to the channel TL_1 over the main line to the calling station. The carrier frequencies assigned to the transmitting and receiving channels are now transmitted in the two directions, so that the circuit is in condition for conversation both ways.

When the operator at the distant station (under the conditions assumed) inserted a plug in the jack at that station, thereby transmitting over the main line ML the carrier frequency assigned to the channel RL_1 , the supervisory lamp corresponding at that station to the lamp 25 was caused to glow in a manner similar to that described in connection with the act of plugging in the jack J_1 under the conditions first assumed. This lamp remains glowing until the operator at the station illustrated answers the call by plugging in the jack J_1 , when the lamp is extinguished, thereby indicating to the operator at the distant station that the

call has been answered. The operation of extinguishing this lamp will be clear from a consideration of the operations taking place in connection with the lamp 25 at the station illustrated when the station illustrated is the calling station and the distant station the receiving station, as was the case under the conditions originally assumed. Remembering that under these conditions the relay 26 is energized and the relay 24 deenergized, the circuit of the lamp 25 is completed as originally described. When the distant operator, in response to the transmission of the carrier frequency over the transmitting channel with the consequent glowing of the lamp at the distant station, inserts a plug in the jack at that station, the receiving carrier frequency of the illustrated station will be transmitted back over the line ML to the channel RL_1 . This frequency passes through the filter RF''_1 to the rectifier R_1 , and the rectified current actuates the relay 24, which opens the circuit of the signal lamp 25, thereby indicating to the calling operator that the call has been answered.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:—

1. In a carrier signaling system a main transmission line, means to transmit a carrier frequency over said line when a connection is made therewith at one end, means to impress signals upon said carrier frequency, and means responsive to the transmission of the carrier frequency to actuate a supervisory signal at the distant end of said line.

2. In a carrier signaling system a main transmission line, means to transmit a carrier frequency over said line when a connection is established therewith at one end, means to impress signals upon said carrier frequency, means responsive to the transmission of said carrier frequency to actuate a supervisory signal at the other end of said line, and means to extinguish said signal upon the establishment of a connection with the main line at said distant end.

3. In a carrier signaling system a main transmission line, means to establish connections therewith at either end, means responsive to the establishment of a connection therewith at one end to operate a supervisory signal at that end and transmit a carrier frequency to the distance end, means to impress signals upon said carrier frequency and means responsive to the establishment of a connection at the distant end of the line to extinguish the signal at said first mentioned end.

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4. In a carrier signaling system a main transmission line, means to establish connections therewith at either end of said line, means responsive to the establishment of a connection with said line at one end to operate a supervisory signal at said end and to transmit a carrier frequency to the distant end, means to impress signals upon said carrier frequency, means responsive to the establishment of a connection with the distant end of said line to transmit a carrier frequency in the reverse direction, and means responsive to the transmission of the carrier frequency in the reverse direction to extinguish the supervisory signal at the first mentioned end of said line.

5. In a carrier signaling system a main transmission line, means to establish connections therewith at either end of said line, means responsive to the establishment of a connection with one end of said line to actuate a supervisory signal at said end and to transmit a carrier frequency to the distant end of said line, means to impress signals upon said carrier frequency, means responsive to the transmission of said carrier frequency at the distant end to actuate a supervisory signal at that end, means responsive to the establishment of a connection with the distant end of said line to extinguish the supervisory signal at that end and to transmit a carrier frequency in the reverse direction of said line, and means re-

sponsive to the transmission of a carrier frequency in the reverse direction to extinguish the supervisory signal at the said first mentioned end of the line.

6. A telephone system for low and high frequency telephony having subscribers operating with low frequency currents while the connection between the operating places or exchanges can take place with high frequency oscillations, characterized in that means are provided for releasing high frequency currents at the calling exchange in response to the establishment of a connection, and a calling signal is provided at the wanted exchange responsive to the transmission of said high frequency currents.

7. In a telephone system in which lines connecting a subscriber to an exchange operate only with low frequency currents, the combination of means whereby in response to the establishment of a connection from a subscriber the generation at his exchange of high frequency currents will start, means for transmitting those currents to the ordinary junction lines connecting that exchange to a second exchange, and means for indicating at the second exchange the incoming of a high frequency call.

In testimony whereof, I have signed my name to this specification this 30th day of December 1920.

HERMAN A. AFFEL.