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SIGNALING SYSTEM

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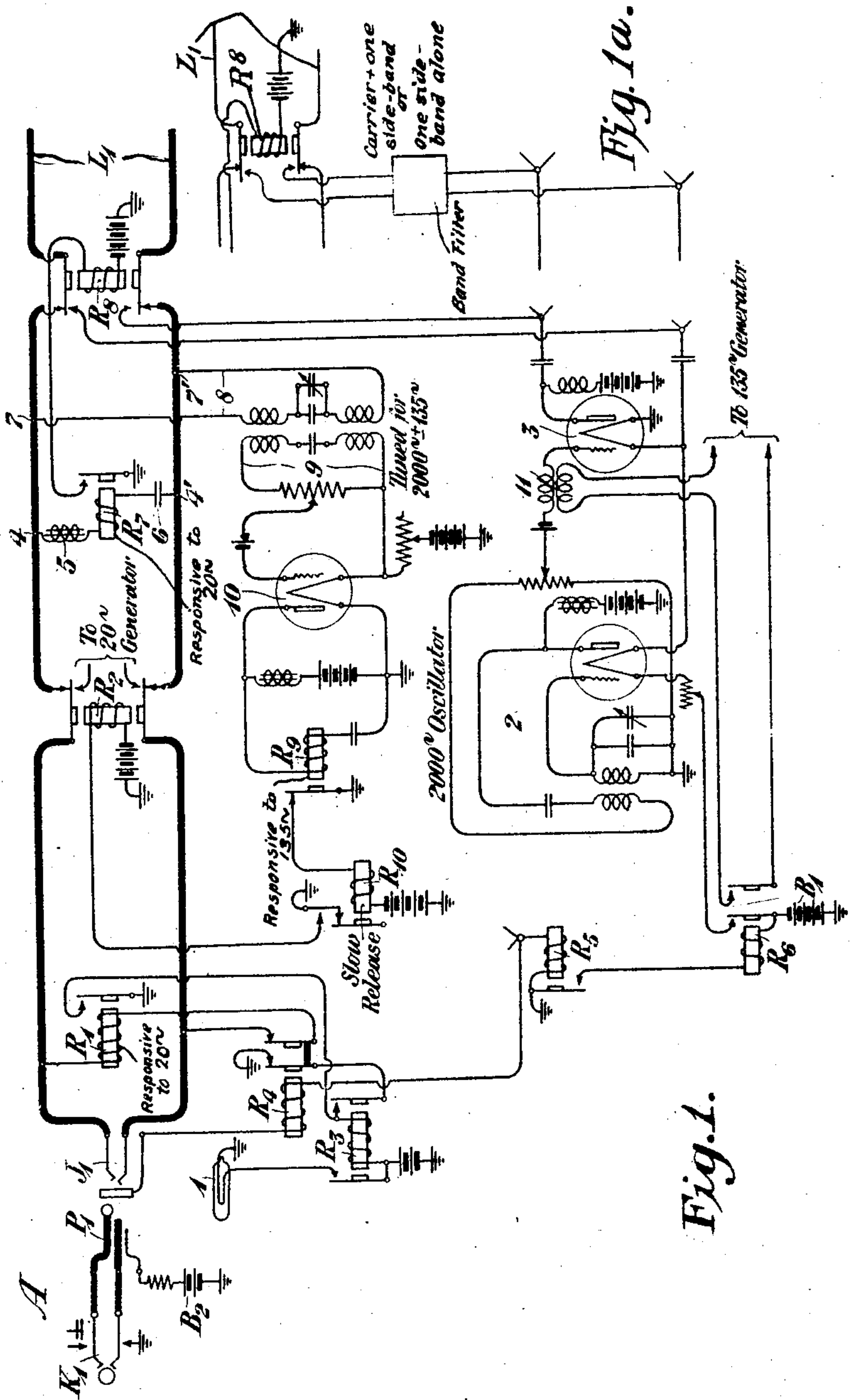


Fig. 1.

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UNITED STATES PATENT OFFICE.

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SIGNALING SYSTEM.

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To all whom it may concern:

Be it known that I, JOHN DAVIDSON, Jr., residing at Trenton, in the county of Mercer and State of New Jersey, have invented certain Improvements in a Signaling System, of which the following is a specification.

This invention relates to signaling systems and particularly to an arrangement whereby the signaling apparatus associated with a telephone circuit may be controlled by means of a modulated high frequency current.

It has been customary heretofore to operate the signaling apparatus associated with telephone circuits by means of currents of relatively low frequencies, that is to say, currents varying from approximately 16 to 133 cycles per second. With the development of long distance telephony and telegraphy, especially through the invention of the so-called carrier systems, it has been found that the signaling frequencies heretofore used could well be used for revenue producing purposes, as for instance for alternating current telegraph. The voice frequency range (which is not available for additional revenue producing channels) was therefore proposed for signaling since talking and signaling are not done at the same time. It has accordingly been found desirable to use signaling currents of higher frequencies so as to take them outside the range of frequencies of the proposed telegraph channels but at the same time to keep the frequency of the telephone signaling current within certain prescribed limits.

It is the object of this invention to provide an arrangement whereby a modulated high frequency signaling current may be impressed upon the line circuit and transmitted thereover as such high frequency current and to demodulate the said high frequency current using its low frequency component for the operation of the terminal signaling apparatus.

Other and further objects of this invention will be apparent from the following description when read in connection with the attached drawing of which Fig. 1 shows one form of embodiment of the invention, and Fig. 1^a shows a detail adapted to be used in connection with the circuit of Fig. 1.

In Fig. 1 L_1 represents a line circuit which terminates at the switchboard of an office A in a jack J_1 which is adapted to have inserted therein the plug P_1 of a cord circuit

which may be of any well-known type. Bridged across the terminating end of the line circuit L_1 is a relay R_1 which is adapted to respond to low frequency ringing current impressed thereon by the operation of the relay R_2 and to cause thereby the operation of the relay R_3 which, in turn, lights the line signal 1. Another relay R_4 associated with the sleeve of the jack J_1 is adapted to open the circuit of the relay R_1 and also to extinguish the line signal lamp 1 when the plug P_1 is inserted in jack J_1 . Also, by the act of inserting a plug in said jack, the relay R_5 is operated which, in turn, operates relay R_6 whereby filaments of the vacuum tubes associated with the oscillator 2 and the modulator 3 are heated thereby setting in operation the said oscillator, and putting the modulator in condition to function properly. The operation of relay R_6 also connects with the modulator circuit a source of 135 cycle current whereby the unmodulated oscillations, for example, 2000 cycles set up by the said oscillator 2, may be modulated. Bridged across the line circuit L_1 at the points 4, 4' is a relay R_7 which, by means of inductance 5 and capacity 6, is made responsive to the low frequency current impressed upon the line circuit by the operator whenever the ringing key of the cord circuit associated with the plug P_1 is operated but is not responsive to high frequency oscillations received over the line L_1 from a distant point. The operation of relay R_7 grounds the winding of relay R_8 which causes the operation of relay R_8 and impresses upon the line circuit L_1 the modulated high frequency oscillations which, as previously stated, were set up by the modulator 3 and its associated apparatus. Bridged across the line circuit L_1 at the points 7, 7' is a circuit 8 which is coupled with the input circuit 9 of a vacuum tube detector 10. The circuits 8 and 9 are tuned for the reception of the modulated frequency which, for example, represents a band resulting from the modulation of the 2000 cycle current with 135 cycle current. These high frequency oscillations are impressed upon the detector 10 and the resulting low frequency current will cause the operation of a sensitive relay R_9 which, in turn, releases the normally operated, slow-release relay R_{10} . This slow-release relay in turn controls the operation of the relay R_2 which

effects the application of the low frequency current, of, for example, approximately 20 cycles, to the relay R_1 which is bridged across the switchboard end of the line L_1 .

5 Having in mind the foregoing description of the parts comprising the arrangement shown in Fig. 1 in which this invention resides, the nature of the invention will be more clearly understood from the following
10 description of the mode of operation of this arrangement.

Let it be assumed that the operator at A desires to signal the operator at the distant end of the line L_1 and that the apparatus
15 connected with the distant end of this line is substantially that shown in the figure. When the operator at A inserts the plug P_1 in the jack J_1 and depresses the ringing key of the cord circuit associated with the plug
20 P_1 , low frequency ringing current will be impressed across the line L_1 . This results in the operation of relay R_7 , since the impedance of the path through this relay is low for current of this frequency. Relay R_7 will
25 be operated thereby operating relay R_8 and the armatures of the latter relay will connect the line side of line L_1 with the contacts with which the source of modulated high frequency signaling current is connected. Furthermore, when the plug P_1 is
30 inserted in jack J_1 , relay R_4 will be operated, thereby removing the bridged relay R_1 from the line, and also relay R_5 will be operated which, in turn, causes the operation of
35 relay R_6 . When relay R_6 is operated current will flow from battery B_1 through the filaments of the oscillator 2 and the modulator 3 and at the same time through the closing of the outer contact of relay R_6 135 cycle
40 current will be impressed upon the circuit of the modulator by means of a transformer 11. The oscillator 2 may be of any well-known type or arrangement and as is well known, such circuits will begin to oscillate
45 as soon as the filament of the vacuum tube connected therewith is heated. Accordingly the unmodulated oscillations from the oscillator circuit 2 will be modulated by the 135 cycle current which is also impressed upon the input side of the modulator 3 and the
50 resulting modulated oscillations will be impressed upon the line circuit connected with the inner contacts of relay R_8 . The resultant modulated high frequency oscillations
55 will be impressed upon the line L_1 and in turn will be impressed upon a circuit at the distant end of the said line circuit similar to the circuit shown in the figure.

The action of these high frequency oscillations at the distant end will be the same as would take place if similar modulated high frequency oscillations were impressed upon the distant end and were received by the terminal circuit shown in the figure.

65 Let it be assumed that such modulated

high frequency oscillations have been impressed upon the line L_1 at the distant end and that the plug P_1 of the cord circuit at A has not been inserted in jack J_1 . The modulated high frequency oscillations will
70 be impressed upon the circuit 8 and those oscillations falling within the frequency range of the tuned circuit 9 will be impressed thereon and in turn will be detected by means of the detector 10. The 135 cycle
75 component of the high frequency wave, which appears in the output side of detector 10 will energize relay R_9 , which will open the circuit of relay R_{10} allowing this armature to drop back. This act results in the
80 grounding of a winding of relay R_2 connected with the line circuit L_1 and 20 cycle ringing current will be impressed upon the relay R_1 which is bridged across the tip and ring side of the switchboard end of the line
85 L_1 . The relay R_3 will accordingly be operated, locking up over a contact of relay R_4 and also lighting the line signal lamp 1. When the operator at A takes up the call by inserting the plug P_1 in the jack J_1 , cur-
90 rent from the battery B_2 of the sleeve of the plug will operate relays R_4 and R_5 . The operation of relay R_4 results in extinguishing the light of the lamp 1 and also opening the circuit of the bridged relay R_1 . The op-
95 eration of relay R_5 results in setting in operation the oscillator and causing thereby the production of modulated oscillations, but in view of the fact that relay R_7 remains inoperative, relay R_8 will accordingly re-
100 main inoperative and the high frequency oscillations from the output side of the modulator 3 will not be impressed upon the line L_1 .

It will be seen that my invention com-
105 prises an arrangement for ringing over telephone circuits by means of modulated high frequency oscillations which are transmitted from one end and detected or demodulated at the other end of the circuit and using the
110 low frequency component for the operation of a sensitive relay which in turn applies low frequency current for the operation of the signals in the manner which is well understood.
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In the form in which this invention has been disclosed in Fig. 1 not only is the unmodulated carrier frequency transmitted but also both of the side bands arising from the superposition thereon of the 135 cycle
120 modulating current. However, by the insertion in the circuit between the modulator and the relay R_8 of suitable filters of any well known type as shown in Fig. 1^a, only one side band may be transmitted which
125 may be detected by means of a suitable tuned circuit connected with the circuit of the detector 10. By adjusting the filters, which may be of the band type, both the carrier and one band may be transmitted.
130

Although this invention has been disclosed as embodied in a particular form for arrangement of parts, it is to be understood it is capable of embodiment in other and different forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a signaling system the combination of a line circuit, a cord circuit having a source of ringing current connected thereto, a source of high frequency oscillations, a source of low frequency variations, means to modulate said high frequency oscillations by the said low frequency variations, and means controlled by the connection of the said cord circuit with the said line circuit to effect the modulation of the said high frequency oscillations by the said low frequency variations.

2. In a signaling system the combination of a line circuit, a cord circuit having a source of ringing current connected thereto, a source of high frequency oscillations, a source of low frequency variations, means to modulate said high frequency oscillations by the said low frequency variations, and means controlled by the application of the low frequency ringing current to the said line circuit to cause the said modulated high frequency oscillations to be impressed upon the said circuit.

3. In a signaling system the combination of a line circuit, a cord circuit adapted for connection with the said line circuit and having a source of low frequency ringing current associated therewith, a source of modulated high frequency oscillations, and means responsive to the application of low frequency ringing current to the said line to control the connection of the said source of modulated high frequency oscillations to the said line circuit.

4. In a signaling circuit characterized by the transmission thereover of modulated high frequency waves, the combination with a line circuit of a line relay and signal associated therewith, a detector adapted to demodulate the said waves, a second relay controlled by the low frequency component of said detected wave, and a source of low frequency ringing current adapted to be connected by said second relay with the said line relay and to operate the said signal.

5. In a signaling circuit characterized by the transmission thereover of modulated high frequency waves, the combination of a line circuit having a line signal connected therewith, a cord circuit, a source of modulated high frequency oscillations, means con-

trolled by the said cord circuit to impress the said high frequency oscillations upon the said line circuit, a detector circuit adapted to have impressed thereon high frequency oscillations received over the said line circuit from its opposite end, and means connected with the output side of the said detector circuit for controlling the operation of the line signal connected with the said line circuit.

6. In a signaling system the method for operating the line relay associated with long telephone circuits which consists in generating high frequency oscillations, modulating the said high frequency oscillations with low frequency variations, impressing the said modulated oscillations upon the line circuit, receiving the said modulated oscillations at the opposite end of the line circuit by a detector circuit tuned to reception frequency, and impressing the detected low frequency component upon a relay adapted to control the operation of the line signal by means of low frequency current.

7. In a signaling circuit, the combination with a line circuit of a terminal circuit having a link circuit associated therewith, the said terminal circuit comprising means for generating a modulated high frequency wave, means for receiving and detecting a modulated high frequency wave, and means controlled by the connection of the said link circuit to the said terminal circuit to disconnect the said receiving and detecting means from the said line circuit when the said generating means is connected therewith.

8. In a communication system comprising a low frequency communication circuit adapted to be connected with a carrier frequency transmission circuit, the said carrier frequency circuit having means associated therewith for generating a carrier frequency current modulated by an intermediate frequency signaling current, the method of signaling which consists in connecting the said low frequency communication circuit with the said transmission circuit controlling thereby the generation of the high frequency carrier current and its modulation by the intermediate frequency current, and applying low frequency signaling current from the said low frequency circuit to the high frequency circuit to control the application of the modulated carrier current to the said high frequency transmission circuit.

In testimony whereof, I have signed my name to this specification this 21st day of December 1920.

JOHN DAVIDSON, JR.