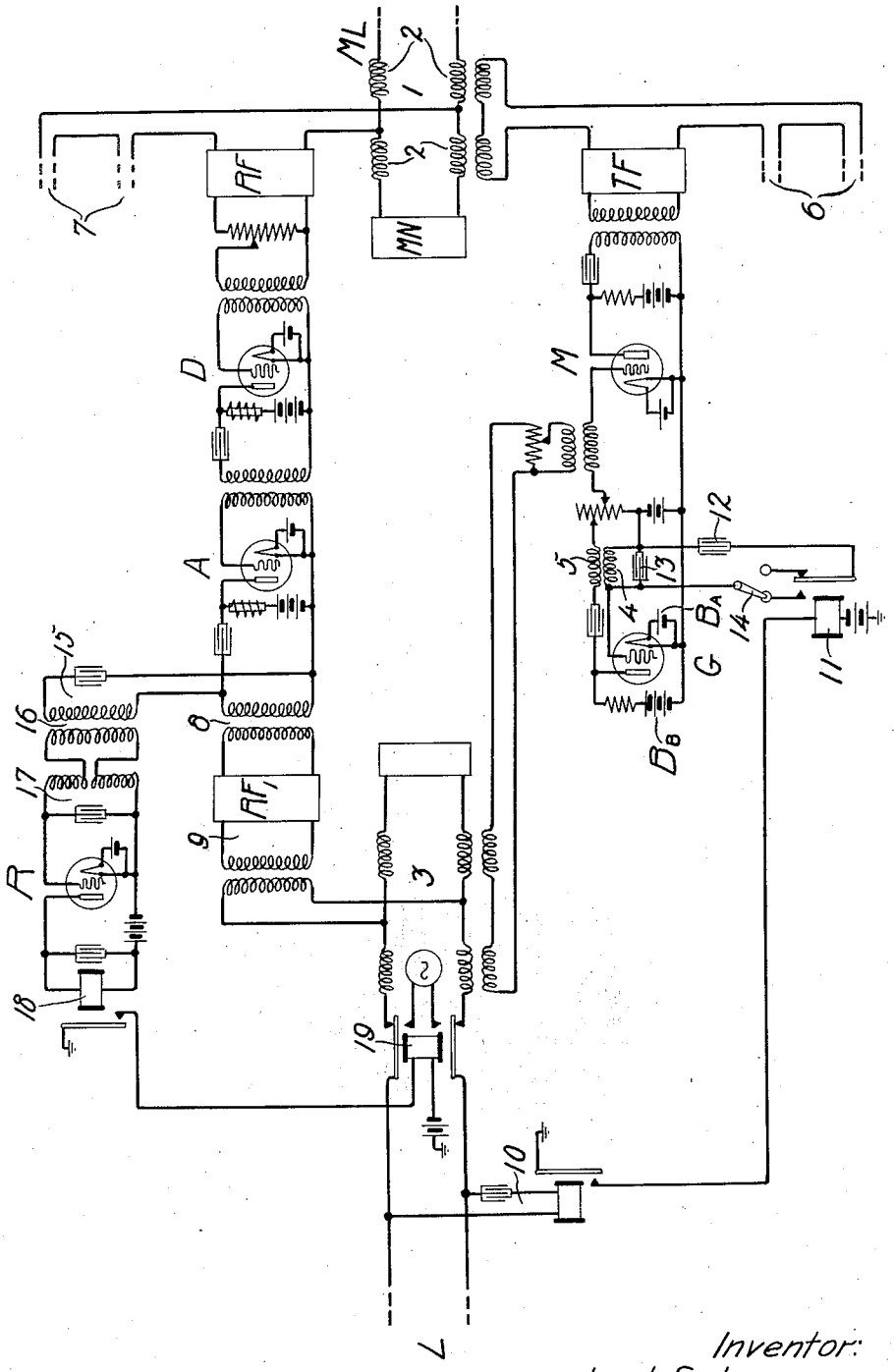
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CALL SIGNALING SYSTEM

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CALL SIGNALING SYSTEM.

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This invention relates to a call signaling system and particularly to a means for call signaling over a carrier current transmission system.

A principal object of the invention is to transmit call signal impulses over a carrier wave transmission system.

A more specific object of the invention is to transmit call signal impulses over an intelligence communication system of the modulated carrier current type by changing the carrier frequency from the value normally used for intelligence communication.

A further object of the invention is to provide a signal system adapted to be used in carrier current systems in which means are provided for preventing interference with the signal by a simultaneously actuated intelligence transmitting means.

The invention, which is applicable generally to carrier current systems, consists in essence in operating call signal apparatus at a receiving station by carrier waves transmitted from a transmitting station and differing in frequency from the carrier frequency of waves modified in accordance with messages and transmitted between the same stations. Where the carrier wave for transmitting messages is continuously transmitted, as in the so-called closed circuit carrier wave communication systems a calling signal may be transmitted by changing the frequency of this carier wave to the different carrier frequency used for calling. The calling signal receiving apparatus will accordingly be made to respond whenever this change occurs in the frequency of the normally transmitted message carrier wave.

The word "signaling", as used throughout the specification, is distinguished from "intelligence communication" and "signal" is used to denote a ringing or calling means. The expression "intelligence communication" which has sometimes been given a broad meaning, limited only by the literal signification of the words, will be used here to exclude the mere calling or "signalling" and will include within its meaning telegraphic or telephonic transmission of intelligence.

The principle of the invention may be applied to any carrier current transmitting system whatever and accordingly may be used in a simplex or multiplex system and in wire or radio systems.

The invention, the general features of which have been described above, will now be described in detail in connection with a preferred system which has been illustrated by a drawing, the single figure of which shows the circuits of a complete two-way transmitting and signaling unit of a multiplex transmission system.

In the drawing there are shown the necessary circuits which would enable one to conduct a complete two-way conversation from low frequency line L over the carrier line ML to a distant station, and to transmit and receive ringing signals over the carrier line. In a practical case the line L would be a subscriber's loop and some of the operations which, for simplicity, will be indicated as originating in the low frequency line would be performed by a central station operator. The circuits may terminate in a carrier line as shown, or in a radiating conductor in the case of a radio system, the terminal circuit arrangements for modulated carrier transmission being equally applicable to each.

Describing first the circuits for intelligence communication, the carrier line ML terminates in a balancing network MN to which it is connected by the series windings 2 of the balanced transformer or hybrid coil 1. With a condition of balance established, the high frequency transmitting and receiving circuits connected respectively with the series windings and bridge circuit of the hybrid coil, are completely conjugate to each other with respect to line ML. There is a similar low frequency balanced transformer and network arrangement 3 for the purpose of connecting the low frequency transmitting and receiving circuits to the low frequency line L.

Oscillation generator G is representative of various types that may be used, the only essential feature for the purpose of this invention being the inclusion of a frequency determining circuit 4 by the adjustment of the reactive elements of which the frequency of the generator may be varied.

The generator has the usual inductive coupling between the input and output circuits. Batteries BA and BB, respectively sup-

ply energy to the filament and to the space circuit. The input circuit of modulator M receives current of carrier frequency from the generator G and at the same time receives low frequency current, for example, speech current from the line L through the hybrid coil 3. The modulator functions in the usual manner to produce in its output circuit a speech modulated carrier wave comprising upper and lower sidebands and also to transmit some energy of the carrier wave frequency without modulation. The band filter TF may be of the well known Campbell type which has been described in Patent No. 1,227,114 patented May 22, 1917. As here used the filter is designed to pass the unmodulated carrier frequency component and one side band which are transmitted to line ML through balanced network system 1. Reference numeral 6 indicates additional transmitting channels.

Carrier current modulated by telephonic frequency currents is received over line ML and is transmitted through the balanced network and through the band filter RF to detector D, filter RF being similar to filter TF. Reference numeral 7 indicates circuits of additional receiving channels for multiplex operation. It should be noted that filter TF functions to provide the necessary selectivity in multiplex operation as well as to suppress one of the side bands, filter RF functioning similarly.

The detector or demodulator functions in the usual manner to produce low frequency currents of the same character as those used at the distant transmitter to modify the transmitted carrier wave. The detector also operates to a degree as an amplifier of the received high frequency current and accordingly transmits corresponding high frequency waves from its output circuit whenever high frequency waves are received. The detected currents are amplified by amplifier A and transmitted by transformer 8 to circuit 9 in which low pass filter RF_1 suppresses the high frequency components and permits only waves of telephonic frequencies to pass. Currents of telephonic frequencies are transmitted through balanced circuits 3 to an indicating device (not shown) in line L.

Considering now the signaling feature of the invention, low frequency signaling impulses, as from a 16 cycle source, are transmitted over line L. This current is picked up by tuned circuit 10 which therefore constitutes a substantial short-circuit of the line for currents of this frequency and prevents the modulation of the carrier wave thereby.

A relay in tuned circuit 10 actuates a circuit closer which energizes the relay 11. This relay closes a circuit through condenser 12 and places this condenser in parallel with condenser 13 and accordingly increases the total capacitance of the circuit 4. This function is desirable in the case that the lower side band is normally transmitted since it results in a decrease in the carrier frequency. The changed frequency carrier wave may be made to occupy substantially the middle portion of the normally transmitted frequency band. If the filter TF, on the other hand, is designed to transmit the unmodulated carrier wave component and upper side band, it is desirable to decrease the capacitance in circuit 4 and this may be accomplished by changing the position of switch 14. In this alternative operation, the relay contact is so adjusted that the circuit is normally closed through 12 and is opened by relay 11.

The changed carrier frequency current is transmitted through filter TF and balanced network circuits 1 to the distant station. Since the circuits for receiving the signals at the distant station are identical with the receiving circuits at the station shown, they will be described with reference to the latter station. The received signaling current passes through the circuits 1 and band filter RF to detector D. There being only a single frequency, the current is transmitted unchanged, except as it may incidentally be amplified, to amplifier A. The tuned circuit 15 is resonant to the changed carrier frequency and hence this circuit picks up the signal current and transmits it by means of transformer 16 through secondary tuned circuit 17 to thermionic relay device R. Tuned circuit 15 is sufficiently selective to discriminate between the normal and changed carrier frequency and it will not respond to the side band frequencies, the amplitudes of the currents corresponding to which are small as compared with that of the changed frequency signal wave. Accordingly, tuned circuit 15 will be practically unaffected by the transmitted currents during normal message transmission. Relay R operates in a well known manner to produce a change in its space current during reception of the changed frequency carrier current and the change in space current is sufficient to cause relay 18 to operate. Relay 18 closes the circuit of relay 19 which disconnects the low frequency circuit L from the two-way channel and connects it to a local ringing source as shown.

Although the invention has been specifically described with reference to a carrier telephone system, it should be understood, as has been explained above, that it is not so limited in application but may be used, as well, in a carrier telegraph system or, conceivably in a carrier current system adapted for power transmission. It should further be understood that it is not limited in scope to use in an intelligence communication system, to the particular system shown, or even

to wire transmission, but only by the appended claims.

What is claimed is:

1. In a modulated carrier current transmission system in which the transmitted band consists of the unmodulated carrier frequency component and one side band, the method of signaling which includes the steps of changing the carrier frequency to substantially the centre of said transmitted band and selectively indicating the currents of said changed carrier frequency.

2. A transmission system comprising a transmitting station, a distant receiving station having a controlled device and message receiving means, means at said transmitting station for normally transmitting to said receiving station a wave of a given frequency, means for modifying said wave to transmit messages, means for changing the frequency of said transmitted wave, means at said distant station for demodulating said message-modified wave, and means coupled to the output of said demodulating means responsive only to said wave of changed frequency to operate said controlled device.

3. In a signaling system comprising a transmitting station and a distant receiving station, a source of carrier current, means for modifying said carrier current in accordance with messages and for transmitting from said transmitting station to said distant receiving station the carrier current so modified, means at said distant station for detecting the received carrier current and indicating said messages, means for shifting the fequency of said carrier current whereby signaling indications may be transmitted over said system, means at said distant station for selecting from said detecting means the incoming current of shifted frequency and for rectifying it, and a signal operated by the rectified current.

4. In a signaling system, a high frequency energy transfer circuit, means included in said transfer circuit for supplying low frequency modulated carrier waves and for changing the frequency of the carrier waves, a low frequency circuit, means interconnecting said circuits comprising demodulating apparatus whereby low frequency impulses may be transmitted to said low frequency circuit corresponding to the modulations of a particular high frequency carrier wave, and resonant circuit means connected in energy transfer relation to the output circuit of said demodulating apparatus responsive only to a changed carrier frequency.

5. In a signaling system, a high frequency circuit, a low frequency circuit, a source of carrier current, means whereby modulated carrier current may be transmitted over said high frequency circuit, demodulating means interconnecting said circuits, means for changing the carrier frequency of the transmitted current, a selective circuit connected in energy transfer relation with the output of said demodulating means responsive only to the changed carrier frequency current, and means associated with said selective circuit for utilizing said changed carrier frequency current to operate a calling device.

6. In a system for signaling over a carrier current system, a high frequency energy transfer circuit, a low frequency circuit associated with each terminal of said high frequency circuit, means interconnecting said circuits at one terminal of said high frequency circuit whereby low frequency impulses may be transmitted from said low frequency circuit over said high frequency circuit as modulated carrier oscillations, said means including a carrier frequency oscillator, means interconnecting said high frequency and low frequency circuits at the other terminal of said high frequency circuit comprising demodulating means, a band filter in said high frequency circuit so designed as to transmit unmodulated carrier frequency oscillations and one side band of the modulated carrier oscillations, means for changing the carrier frequency to a value corresponding substantially to the mean frequency of the normally transmitted band, and means connected to said demodulating apparatus and responsive only to oscillations of said changed carrier frequency.

7. The combination recited in claim 6 in which the carrier frequency oscillator includes a frequency determining circuit having a reactance, and in which the means for changing the carrier frequency comprises means in shunt with said reactance for changing the electrical condition of said circuit.

8. The combination recited in claim 6 in which the carrier frequency oscillator includes a frequency determining circuit having a capacitance and in which the means for changing the carrier frequency consists of a relay, a capacitive circuit in shunt with said capacitance, and circuit closing means in said capacitive circuit adapted to be actuated by said relay.

9. The combination recited in claim 6 in which the carrier frequency oscillator includes a frequency determining circuit having a capacitance and in which the means for changing the carrier frequency consists of a relay, a capacitive circuit in shunt with said capacitance, and circuit closing means in said capacitive circuit adapted to be actuated by said relay, and having additional means for energizing said relay from said low frequency circuit.

10. In a carrier wave communication system having transmitting and receiving stations, a carrier wave channel including at

the transmitting station circuits for generating a carrier wave and for modulating the carrier wave in accordance with message waves to be transmitted, and at the receiving station circuits for demodulating the message modulated wave to reproduce the message currents, said channel including also a band filter for selectively transmitting frequency components of the message modulated wave lying to one side of the said carrier wave frequency in the frequency spectrum while suppressing the components of the message modulated wave lying to the other side of said carrier wave frequency, means for transmitting signaling indications through said channel comprising means at the transmitting station for changing the carrier frequency to a level within the range of free transmission of said filter, means at the receiving station for selectively receiving the said wave of changed frequency and a signal device controlled by the selected wave.

11. In a signaling system, a transmitting station, a distant receiving station having call signaling apparatus, a source for supplying carrier waves of given frequency at said transmitting station, means to modulate said carrier waves in accordance with signaling waves whereby a band of frequencies adjacent said carrier wave frequency is produced, means to select and transmit the carrier and the said band lying to one side of the carrier to the exclusion of other frequencies, and means at said transmitting station to change the carrier frequency to one within said band of frequencies to operate said call signaling apparatus.

12. In a carrier wave signaling system, a source of speech frequency current, an electron discharge oscillator for producing carrier current, a modulator whereby said carrier current is modulated in accordance with current from said speech frequency current source, conductors extending between said speech frequency current source and said modulator, a condenser for determining the frequency produced by said oscillator, a second condenser associated with said first mentioned condenser, and means actuated by current flowing in said conductors to change the manner of association of said second condenser with respect to said first mentioned condenser to change the frequency of the generated oscillations.

In witness whereof, I hereunto subscribe my name this 22" day of December A. D., 1920.

JACOB S. JAMMER.