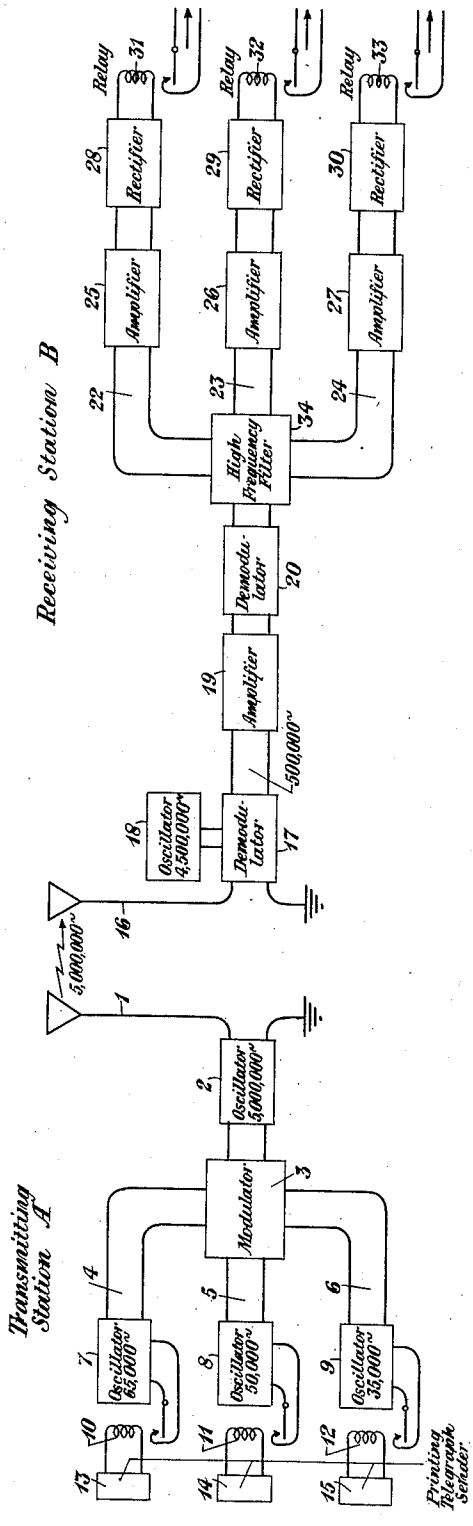
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MULTICHANNEL RADIO PRINTING TELEGRAPH SYSTEM

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MULTICHANNEL RADIO PRINTING-TELEGRAPH SYSTEM

Application filed December 24, 1924. Serial No. 757,925.

This invention relates to printing telegraph systems, and particularly to a system of that type in which the printing telegraph impulses are transmitted by radio frequencies of a high order of periodicity.

In my copending application, Serial No. 757,927, filed December 24, 1924, I have disclosed a radio printing telegraph system characterized by a beating down at the receiving station of the impulses of radio frequency to impulses of a lower frequency above the limits of audibility, the said impulse of lower frequency being then rectified and impressed upon a printing telegraph receiver, operating the said receiver in the same manner in which it is operated by direct current impulses transmitted over a line circuit.

The advantage derived from the rectification of a current of a frequency above the limits of audibility, as, for example, of the order of 50,000 to 100,000 cycles, is that the rectified current builds up to the value necessary to operate the magnets of the printing telegraph receiver in a shorter period of time than is practicable where voice frequencies are rectified. In this manner distortion and other detrimental effects upon the received printing telegraph signals are eliminated.

The present invention resides in the application of the principle set forth in the said copending application to a multi-channel radio printing telegraph system.

Other objects of this invention will be apparent from the following description when read in connection with the attached drawing showing schematically a form of embodiment of the invention.

In the drawing the transmitting station A comprises an antenna 1 having connected therewith an oscillator 2 and a modulator 3. Connected with the modulator are three branch circuits 4, 5 and 6 which serve to connect with the modulator the oscillators 7, 8 and 9, respectively. The transmission of a train of oscillations from each of the oscillators 7 to 9, inclusive, is controlled by means of the relays 10, 11 and 12 connected with the printing telegraph transmitters 13, 14 and 15. These transmitters may be of any well-known type having a distributor comprising a rotating arm and a plurality of segments in the face of the said distributor. As the arm rotates it successively controls the circuit through the said segments and the windings of the relays 10, 11 and 12. Thus, for example, if the character to be transmitted consists of two closed and three open impulses, current will flow, for example, through the winding of relay 10 during the periods of travel of the distributing arm over two segments, and the circuit through the said winding will be open during the periods represented by the time of travel over the remaining three segments. The energization of the winding of relay 10 will control the oscillator 7 in such manner as to cause the transmittal over the line 4 of a train of waves of constant amplitude, the duration of the said train being dependent upon the time consumed by the travel of the rotating arm over one of the segments. This train of oscillations impressed upon the modulator 3 will serve to modulate the oscillations from the source 2 producing side bands of the carrier frequency. One of these side bands, together with the carrier frequency, will be impressed upon the antenna 1 and radiated to the antenna at the distant receiving station. While the drawing represents schematically the well-known Heising system of plate modulation, any other system may be employed to carry out the invention. In like manner the oscillators 8 and 9 are controlled by the printing telegraph transmitters 14 and 15.

In order to be able to separate the impulses of the different channels, different transmitting frequencies are employed. Thus, for example, the frequency of the oscillator 8 may be set at 50,000 cyles, and the frequency of the oscillators 8 and 9 may be separated from that of oscillator 8 by 30% thus making these frequencies 65,000 and 35,000 cycles, respectively. For reasons set forth in the copending application referred to hereinbefore, it is desirable to employ for the transmission of the closed impulses a carrier frequency modulated by a frequency that is well above

the limit of audibility, as, for example, 50,000 to 100,000 cycles. The rectification, at the receiving station of impulses of the modulating frequency, effects a rapid building up of the direct current impulses which operate the control magnets of the printing telegraph receiver. The frequency of the oscillator 2 should preferably, though not necessarily, be of a very high order of periodicity, as, for example, from 5,000,000 to 100,000,000 cycles. Short wave length transmission has many desirable characteristics, one of which resides in the inexpensiveness of the antenna structure necessary for the transmission and reception of such waves. This feature, in itself, renders it practicable to employ a radio system of transmission, which otherwise might not be commercially employed.

The receiving station B comprises an antenna 16 connected with a demodulator 17 which in turn has connected therewith an oscillator 18. Since the antenna 16 is intended, for example, to receive the carrier frequency of 5,000,000 cycles and also the signaling frequencies ranging from 35,000 to 65,000 cycles superposed upon the said carrier frequency, the frequency of the oscillator 18 should be set at 4,500,000. The output of the demodulator is connected with a tuned high frequency amplifier 19 which in turn is connected with a second demodulator 20 which detects the signaling impulses of 35,000, 50,000 and 65,000 cycles. The output of the demodulator 20 is connected with a high frequency filter 21 by means of which the impulses of each particular channel may be separated by virtue of their frequency difference and impressed upon the proper branch circuits. Thus, for example, into the branch circuit 22 would flow the impulses originating in the transmitter 13 at the sending station and similarly into the branch circuits 23 and 24 would flow the impulses from the transmitters 14 and 15, respectively. These received impulses, which are of the frequencies produced by the oscillators 7 to 9, inclusive, would be amplified by the high frequency amplifiers 25 to 27, inclusive, and the said high frequency impulses would be rectified by the rectifiers 28 to 30, inclusive. The rectified impulses control the operations of the relays 31, 32, and 33 which in turn control the printing telegraph receiving apparatus. Since the latter may be of any well-known type, it needs no further description.

The method of operating the system will be apparent by considering the transmission of the signals over one channel. When the distributor 13 at the transmitting station A closes the circuit of relay 10 for the transmission of a closed impulse, the oscillator 7 is so controlled as to transmit a train of waves at the frequency of 65,000 cycles over the branch circuit 4 to the modulator 3. The length of this train of waves corresponds to the time required for the movement of the distributing arms over a segment of the distributor 13. This train of waves will modulate the high frequency carrier producing trains whose frequencies are 5,065,000 cycles, and 4,935,000 cycles, the latter frequency being suppressed. This wave of 5,065,000 cycles, together with the carrier of 5,000,000 cycles would be transmitted from the antenna 1 and received by antenna 16 at the receiving station B wherein it would be impressed upon the modulator 17 and beaten with the frequency of 4,500,000 cycles derived from the oscillator 18. The resultant frequencies, namely, 565,000 cycles, and 500,000 cycles, would be amplified by the device 19 and impressed upon the demodulator 20. Herein these two frequencies would beat together and the resultant impulse of 65,000 cycles would be selected by the filter 21 and impressed upon the branch circuit 22 wherein it would be amplified by the device 25 and rectified by the device 28. The rectified impulse would operate the relay 31 and transmit a closed impulse to the printing telegraph receiver. In like manner, an impulse of 50,000 cycles transmitted by the oscillator 8 at the transmitting station A would be received at station B and converted in the demodulator 20 into an impulse of 50,000 cycles which in turn would be impressed upon the branch circuit 23 and rectified by the device 29. Similarly a closed impulse from the station A which would have a frequency of 35,000 cycles, would be received at station B and translated into a frequency of 35,000 cycles by the device 20, which frequency would be impressed upon the branch circuit 24 and rectified by the device 30.

By employing relatively high frequencies, as, for example, of the order of 50,000 cycles, instead of frequencies within the voice range, say, 1,000 cycles, at the transmitting station to modulate the carrier frequency, it is practicable to avoid subsequent difficulty that might arise from uncontrollable variations of the carrier frequency, which, as stated, is of the order of 5,000,000 to 100,000,000 cycles. A change in the frequency of the carrier oscillator of a small fraction of 1% would be relatively great compared with the voice frequency, but would not be so great in comparison with frequencies well above the limits of audibility, such as 50,000 to 100,000 cycles. Consequently, when these higher frequencies are used as modulation frequencies of the carrier frequency, slight variations in the oscillator frequency will not cause practical difficulties in the reception of the signal impulses. If the receiving station employs intermediate frequency amplification, the beating frequency for this intermediate stage should preferably be about 1/10 of the

frequency of the basic carrier, and the ratio between the different channel frequencies is about 100 to 1 compared to the carrier frequency.

It will be seen that by means of the invention disclosed herein it is practicable to transmit over a radio system a plurality of printing telegraph messages without interference therebetween. Furthermore, by rectifying the impulses at a fairly high frequency, say of the order of 50,000 to 100,000 cycles, it is possible to avoid the difficulties inherent in the detection of the impulses at much lower frequencies, such as are found within the voice range.

While this invention has been disclosed schematically in a certain form of embodiment, it is not so limited, being capable of embodiment in other forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a multi-channel radio printing telegraph system the combination with a source of ultra high frequency carrier oscillations, of a plurality of sources of signal oscillations differing in frequency each from the other and from the said carrier oscillations, a printing telegraph transmitter individual to and connected with each of the said sources of signal oscillations having means to effect the transmission or suppression of a train of signal oscillations depending upon whether a closed or an open impulse of the printing telegraph code is to be transmitted, means to modulate the carrier oscillations with the trains of signal oscillations from the several sources, and a receiving station comprising means to receive the modulated carrier oscillations, means to separate the impulses of each channel and means to detect and to translate the said impulses.

2. The method of operating a radio printing telegraph system having a plurality of channels, which consists in generating for each channel signal oscillations of a single frequency, which frequency differs from those of the other channels, modulating ultra high frequency carrier oscillations by a train or trains of the said signal oscillations, each train being effectively a closed printing telegraph impulse of that channel represented by the frequency of the signal oscillations employed in the said train, suppressing transmission of the said signal oscillations whenever an open impulse is to be transmitted over any channel, receiving the oscillations as thus transmitted, and detecting the printing telegraph signals transmitted by the system.

3. The method of operating a radio printing telegraph system having a plurality of channels, which consists in generating for each channel signal oscillations of a single frequency, which frequency differs from those of the other channels, modulating ultra high frequency carrier oscillations by a train or trains of the said signal oscillations, each train being effectively a closed printing telegraph impulse of that channel represented by the frequency of the signal oscillations employed in the said train, suppressing transmission of the said signal oscillations whenever an open impulse is to be transmitted over any channel, receiving the oscillations as thus transmitted heterodyning to an intermediate frequency the received oscillations, amplifying the intermediate frequency, beating the intermediate frequency with another frequency to detect the signal oscillations, separating by filtering the said signal oscillations, amplifying the signal oscillations as thus separated, rectifying each train of signal oscillations, and registering the impulse represented by the rectified train of oscillations.

4. The method of operating a radio printing telegraph system having a plurality of channels, which consists in generating for each channel signal oscillations of a single frequency, which frequency differs from those of the other channels, modulating ultra high frequency carrier oscillations by a train or trains of the said signal oscillations, each train being effectively a closed printing telegraph impulse of that channel represented by the frequency of the signal oscillations employed in the said train, suppressing transmission of the said signal oscillations whenever an open impulse is to be transmitted over any channel, receiving the oscillations as thus transmitted, detecting the signal oscillations, separating by filtering the said signal oscillations, amplifying the signal oscillations as thus separated, rectifying each train of signal oscillations and registering the rectified impulse upon a printing telegraph receiver.

In testimony whereof, I have signed my name to this specification this 23rd day of December, 1924.

RUSSELL S. OHL.