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RADIO PRINTING TELEGRAPH SYSTEM

Filed Dec. 24, 1924

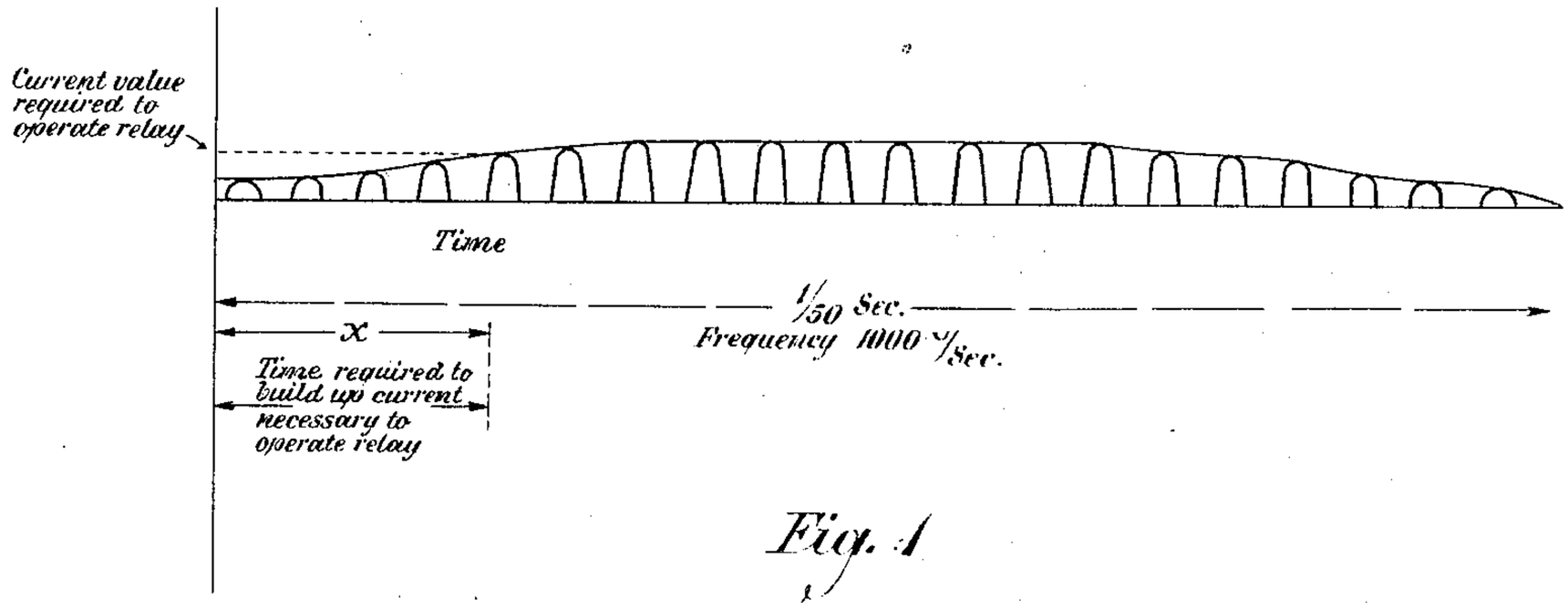

Fig. 1

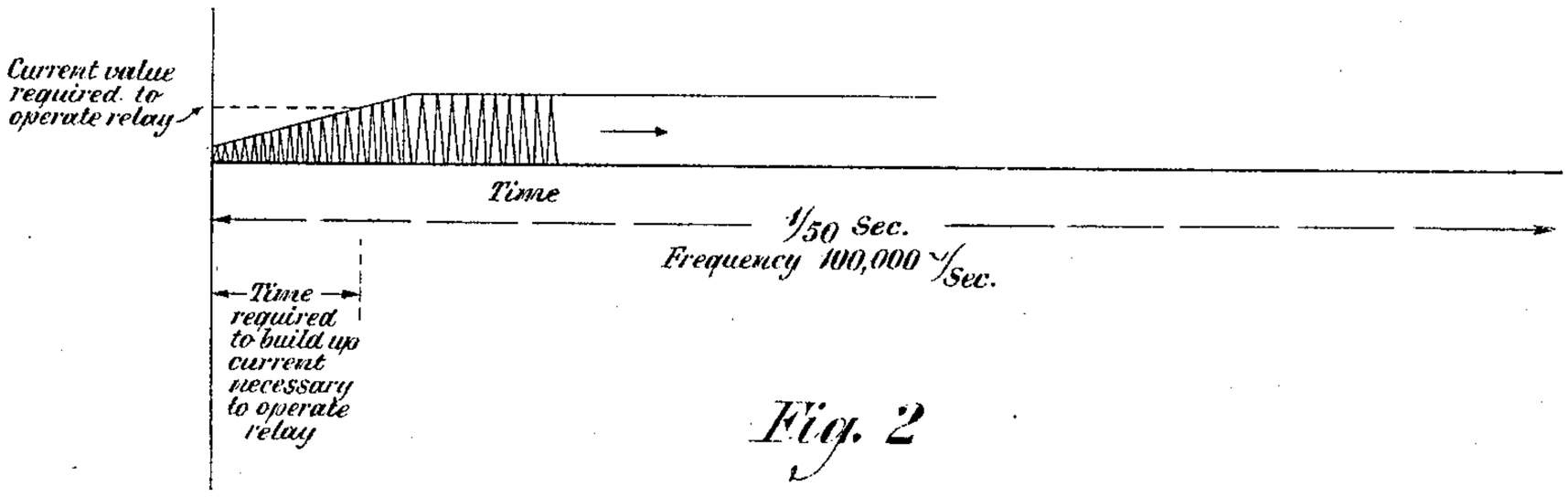

Fig. 2

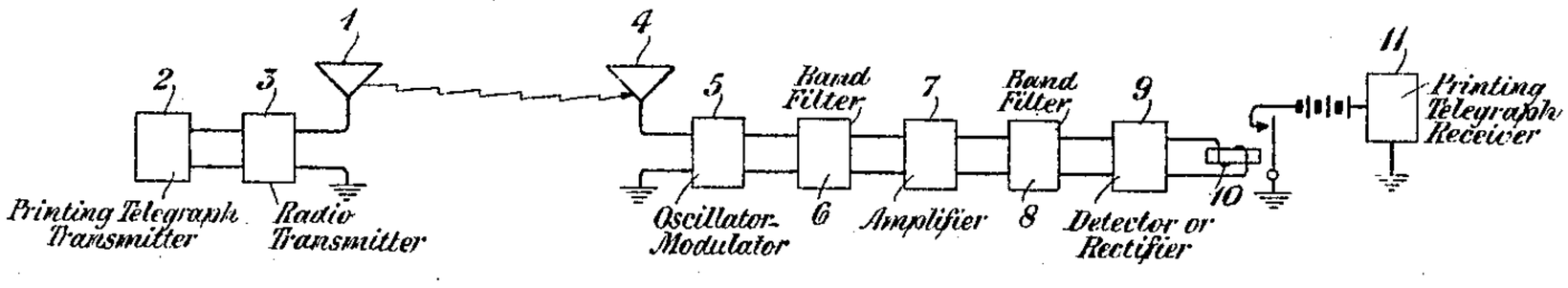

Fig. 3

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RADIO PRINTING-TELEGRAPH SYSTEM

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This invention relates to high frequency signaling systems, and particularly to a radio printing telegraph system in which the wave length of the radiated energy is extremely short.

Printing telegraph systems employing a wire circuit between the stations of the system have been operated for many years and attempts have been made to utilize printing telegraph transmitting and receiving apparatus in connection with radio transmitting and receiving systems. In the operation of a radio printing telegraph system difficulty has been experienced in the receipt of the signaling impulses, which apparently has arisen from beating down the received radio frequency impulses to voice frequency impulses before rectification of the said impulses to operate the magnets of the printing telegraph receiver.

This invention consists of a method and means for the transmission and reception by radio of printing telegraph signals, the system being characterized by a beating down at the receiving station of the transmitting frequency to a lower frequency which is well above the limits of audibility, and by rectification of these high frequency impulses to operate the selecting magnets of the printing telegraph system.

This invention will be apparent from the following description when read in connection with the attached drawing, of which Figures 1 and 2 are graphs illustrative of the principle employed, and Fig. 3 shows schematically a system by means of which the invention may be carried out.

For a clear conception of my invention it seems desirable to briefly set forth certain characteristics of printing telegraph systems. In printing telegraphy the transmission of each letter, number or similar character is effected by five selecting impulses which may be termed either open or closed, depending upon whether the circuit is maintained open or is closed when the rotating arm of a distributor passes over each of a group of segments upon the face of the distributor. When an open impulse is transmitted the selecting magnets of the receiving apparatus will not be energized. A closed impulse will produce such energization. An open impulse represents in effect, a non-application of potential to the line during the time in which the rotating arm of the sender is upon a segment of the distributor; a closed impulse represents an application of potential to the line. In addition to the selecting impulses there are, of course, other impulses such as the starting impulse and the printing impulse, which are closed impulses, but it is unnecessary to describe them in detail, because the invention is not concerned with the function of the transmitted impulses.

In ordinary printing telegraphy, that is to say, in wire systems, each closed impulse represents the application of a direct current potential to the line circuit during the interval in which the distributor arm is upon a segment, and an open impulse represents an absence of applied potential during a similar interval. In radio printing telegraphy each closed impulse consists of a train of waves, the amplitude of which is constant throughout the train. An open impulse is represented in radio printing telegraphy by the suppression of transmission of the high frequency waves.

A clear understanding of the invention will be apparent by considering Fig. 3 in which 1 is the antenna at the transmitting station, 2 is a printing telegraph transmitter which may be of any well known type and 3 is a radio transmitter connected between the printing telegraph transmitter and the antenna. The telegraph transmitter should be so connected with the radio transmitter that when a closed impulse is transmitted by the device 2 a train of waves will be generated by 3 and impressed upon the antenna 1 for transmission to the receiving station. The length of the train of waves will be proportional to the time required for the arm of the distributor to travel over a segment. Likewise an open impulse should result in an absence of transmission of radio frequency waves by the antenna 1. At the receiving station the antenna 4 is connected with the oscillator-modulator 5, the output of which is connected with the amplifier 7 through a

band filter 6. The output of the amplifier is connected with a detector or rectifier 9, the connection including the band filter 8. This band filter may, however, be omitted without reducing the efficiency of operation. The tube of the rectifier is connected with a relay or equivalent device 10 which controls the operation of the printing telegraph receiver 11.

Since the invention is concerned primarily with the transmission of the closed impulses it will be understood that whenever the term "impulse" is used hereafter that it means one of the closed type. Heretofore, in radio printing telegraphy, it has been customary to beat the received impulse of radio frequency one or more times to reduce the frequency of the impulse to a point within the voice range, as for example, 1,000 cycles. This impulse, which then consists of a train of waves of the frequency of 1,000 cycles, is rectified and the resulting direct current impulse used to control a relay connected with the printing telegraph receiver. I have found that such method was productive of so much distortion in the received impulses that errors were introduced into the message as translated by the printing telegraph receiver. The nature of this distortion will be apparent by considering Fig. 1 which indicates the building up of the unidirectional current in the output side of the rectifier to operate the direct current apparatus connected therewith. Assuming the speed of transmission to be fifty cycles per second the length of each impulse would accordingly be one-fiftieth of a second. If the radio frequency impulse is beaten down to a frequency within voice range, say 1,000 cycles per second before being rectified, the number of waves, i. e., cycles in each impulse applied to the rectifier equals twenty, and there will consequently be twenty half-waves in each impulse in the output side of the rectifier. This is shown in Fig. 1. Since these half-waves are relatively widely separated in point of time, owing to the extremely low frequency used, it will take an appreciable amount of time, represented by x to build up the current in the output circuit to the value required to operate the relay associated therewith. This may require at least four cycles, which is 20% of the time length of the impulse. Since the relay controls the printing telegraph receiver there will accordingly be a similar lag in the operation of the receiver. This of course introduces great distortion and results in errors in the received messages.

I have found that if the frequency of the impulses received by the receiving antenna are not beaten down to a point within the voice range but are kept well up in the frequency scale, that is to say, above the limits of audibility, the difficulty inherent in the system just described may be overcome. This will be apparent from a consideration of Fig. 2 which illustrates roughly the rectification of a signaling impulse of the frequency of 100,000 cycles per second.

Owing to the rapidity with which the impulses representing one-half of each wave of the high frequency current are applied to the output circuit of the detector containing the direct current relay, the required current to operate the said relay will be built up in an appreciably shorter time than is required in the system hereinbefore described in which the rectification takes place at the voice frequency. Since the time required to build up the direct current to operate relay controlling the printing telegraph receiver will be shorter where the train of waves to be rectified is of relatively high frequency, say of the order of 50,000 to 100,000 cycles than where the voice frequency is rectified, there will be less distortion of the signal applied to the telegraph receiver, and accordingly, there will be less chance of error in the received message.

Another reason for modulating the ultra-high frequency carrier by another fairly high frequency, of the order of 100 kilocycles instead of by a voice frequency of the order of one kilocycle resides in the difficulty in keeping the carrier frequency sufficiently constant so that the modulating frequency, viz, the speech frequency, when detected will be within the limits of the speech frequency amplifier. For example, a variation of $\frac{1}{10}$ of one per cent in a frequency of 5,000 kilocycles is 5,000 cycles. This variation is five times the speech frequency, but is only five per cent of the other assumed modulating frequency, viz, 100 kilocycles. By using this latter frequency to modulate the carrier, the errors due to variations in the frequency of the carrier current are greatly reduced.

The invention broadly resides in the transmission of the printing telegraph impulses by means of a train of waves of very high frequency of the order of from 5,000,000 to 100,000,000 cycles a second, in receiving the trains of waves of those frequencies, and beating the frequency down to a value relatively small compared with the transmitting frequency, but relatively high with respect to the frequencies within the voice range. The invention is not limited to a particular frequency to be rectified. The point to be considered in carrying out the invention is that the frequency should be above the limit of the voice range, and preferably above audibility, as for example, 50,000 to 100,000 cycles.

The employment of very high frequencies for transmission renders it practicable to receive the transmitted waves by comparatively simple antenna structures. This is important when it is considered that the probable field of use of the invention is in the recep-

tion of news by small newspapers throughout the country from a central broadcasting station.

The invention is not limited to the particular system shown schematically in Fig. 3, but is capable of embodiment in other systems without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a radio printing telegraph system, the combination with a radio transmitting station having means to transmit open and closed printing telegraph impulses, each closed impulse comprising a train of radio frequency waves of constant amplitude, of a receiving station having means to receive the said telegraph impulses, means to beat the radio frequency impulses to a lower frequency, which frequency is above the limits of audibility, means to rectify the train of waves of the said lower frequency, and a printing telegraph receiver responsive to the rectified impulses.

2. In a radio printing telegraph system, the combination with a radio transmitting station having means for modulating a radio frequency carrier by printing telegraph impulses, of a radio receiving station having means to beat down the received radio frequency impulses to a lower frequency which is above the limits of audibility, means to amplify the lower frequency, means to rectify the amplified impulses, and a printing telegraph receiver upon which the rectified impulses are impressed.

3. In a radio printing telegraph system, the combination with a radio transmitting station having means for modulating a radio frequency carrier by printing telegraph impulses, of a radio receiving station having means to beat down the received radio frequency impulses to a lower frequency which is above the limits of audibility, means to rectify the impulses of lower frequency, and a printing telegraph receiver upon which the rectified impulses are impressed.

4. In a radio printing telegraph system, the combination with a radio transmitting station having means for modulating a radio frequency carrier by printing telegraph impulses, of a radio receiving station having means to beat down the received radio frequency impulses to a lower frequency which is above the limits of audibility, means to select the current impulses of the said lower frequency, means to rectify the latter impulses, and a printing telegraph receiver upon which the rectified impulses are impressed.

5. In a radio signaling system, for transmitting printing telegraph messages in which each signal character consists of a plurality of open and closed impulses, the method which consists in transmitting printing telegraph impulses, each closed impulse consisting of a train of radio frequency waves of constant amplitude and each open impulse representing an absence of radiation of waves, receiving the said closed and open impulses, beating down the frequency of the train of waves representing a closed impulse to a value above the limits of audibility, rectifying the train of waves representing the closed impulse and producing a registration of the receipt of the rectified train of waves.

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

RUSSELL S. OHL.