

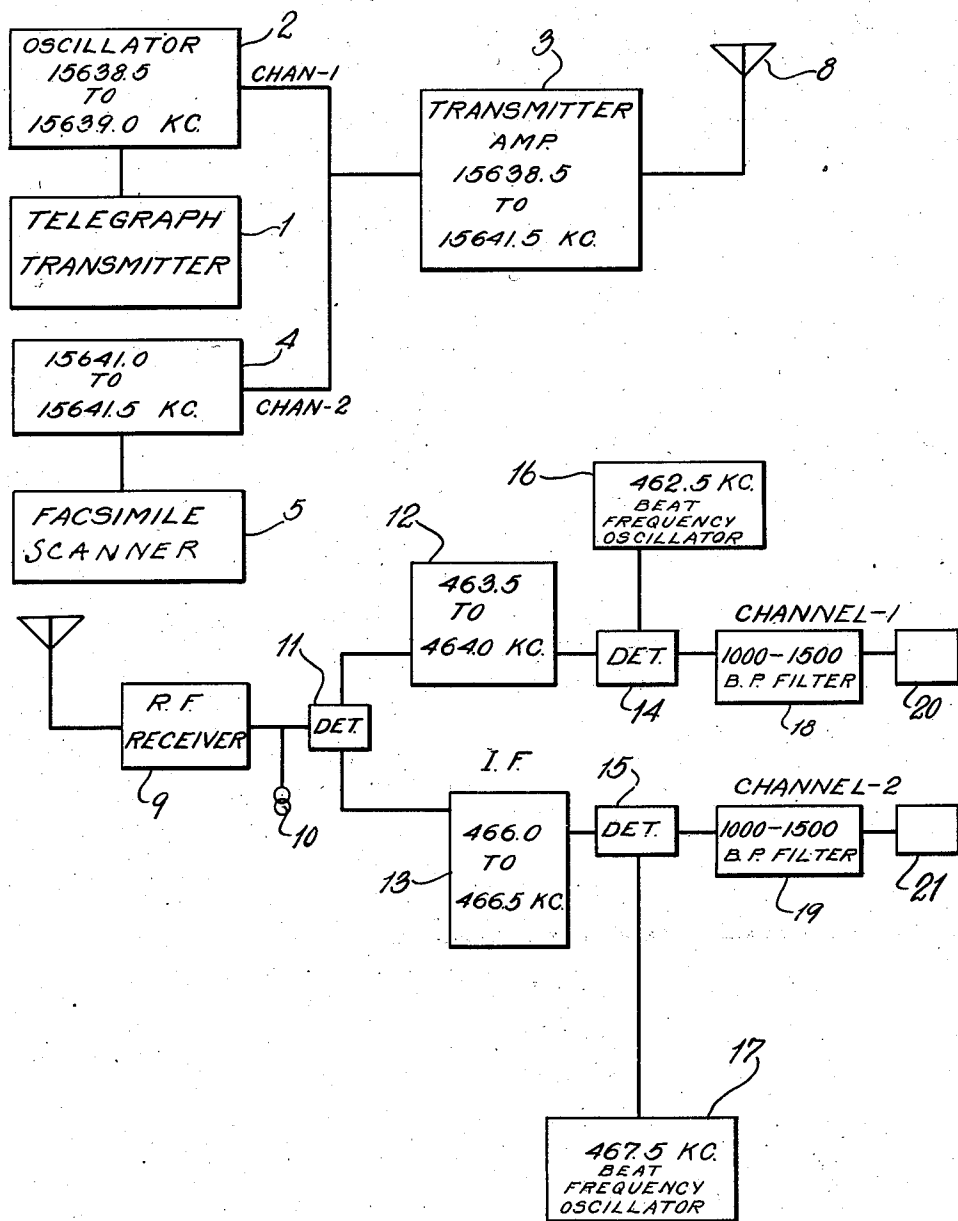
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RADIO SERVICE SYSTEM

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RADIO SERVICE SYSTEM

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This invention relates to radio transmitters and more particularly to arrangements whereby an existing radio transmitter operating at an assigned frequency may simultaneously be used to transmit more than two separate messages.

The invention is in the nature of an improvement on the kind of system disclosed in application Serial No. 498,278, filed August 12, 1943.

A principal object of the invention relates to a radio transmitter system wherein the existing transmitter can be used to transmit two or more intelligence signals by the "carrier shift" method.

A feature of the invention relates to a radio transmitter having means to "frequency shift" the radio frequency carrier over a number of discrete bands.

A further feature relates to the novel organization, arrangement and relative interconnection of parts which cooperate to produce a more efficient and flexible service radio transmitter.

Other features and advantages not specifically enumerated will be apparent after a consideration of the following detailed descriptions and the appended claims.

Inasmuch as the invention relates to improved methods of plural message transmission on existing transmitters, only those parts of a radio transmission system will be schematically illustrated as are required for an understanding of the inventive concept. Accordingly, in the drawing, there is shown in block diagram form a radio transmitter and receiver system embodying features of the invention. There is disclosed in application Serial No. 498,278, filed August 12, 1943, a radio transmitter which is provided with special means for effecting a "carrier shift" to represent two separate signals e. g., "mark" and "space" (in the case of telegraphy), and "black" and "white" (in the case of facsimile). At the same time the shifted carrier is modulated in amplitude to transmit voice or similar signals. Therefore, with the prior system two separate kinds of intelligence signals can be simultaneously transmitted, one by means of carrier shift, the other by amplitude modulation. In accordance with the present invention the transmitter is provided with two or more carrier shift oscillators each of which is independently variable in accordance with respective mark and space, or black and white signals. By a special choice of the limits for each of these carrier shift oscillators, it is possible to use each oscillator as a separate but simultaneous control of the radio-frequency carrier shift without mutual interference, and it is

possible at the receiver to demodulate the respective carrier shifts into mutually independent signal-bearing channels. This latter is accomplished by a specially designed radio receiver preferably, although not necessarily, of the superheterodyne type.

Referring to the drawing, the numeral 1 represents any well-known kind of telegraph keying device e. g., a tape or keyboard telegraph transmitter machine for producing mark and space signals. Associated with machine 1 is an oscillator 2 whose frequency can be shifted over a predetermined selected band under control of machine 1. For example, oscillator 2 may be shiftable between 15638.5 and 15639.0 kc., it being assumed that the existing radio transmitter 3 operates on an assigned frequency of 15640 kc. For a detailed description of one preferred manner of shifting the frequency of oscillator 2 between the desired limits, reference may be had to application Serial No. 498,278, filed August 12, 1943.

A second shiftable frequency oscillator 4 is controlled for example by a facsimile machine 5 whereby the black and white signals from machine 5, shift the frequency of oscillator 4 between predetermined limits, e. g., 15641.0 and 15641.5 kc. At any given instant therefore, there are applied to the radio-frequency exciter stage of the radio transmitter 3 two of the four separate frequencies. It will be understood that the amplifiers of transmitter 3 are designed to amplify uniformly the band between 15638.5 and 15641.5 kc. At any given instant therefore, the antenna 8 radiates two discrete frequencies, the first controlled by device 1, and the second controlled by device 5. If for example at any given instant, antenna 8 is radiating on the upper frequency of 15639.0 kc. from oscillator 2 and also on the lower frequency limit of 15641.0 kc. from device 4, the difference between the two will be 2 kc. Conversely, if antenna 8 is radiating at the lower frequency 15638.5 kc. from oscillator 2 and also the upper frequency 15641.5 kc. from oscillator 4, the difference will be 3 kc.

At the receiving terminal or terminals, are located two radio receivers each tuned to its respective band corresponding to the frequency shift limits of oscillators 2 and 4. Preferably, however, the receiving system is of the superheterodyne type having a radio-frequency amplifier section 9 with its local oscillator 10; a first detector 11 which feeds two separate branched I. F. circuits 12, 13, for converting the received radio-frequency signals into four respective I. F. signals for 463.5 kc., 464 kc., 466 kc., and 466.5 kc. Each I. F.

branch is provided with a second detector 14, 15, each of which has a separate beat oscillator 16, 17. These beat oscillators operate on opposite sides of the mean I. F. of 465 kc. For example, oscillator 16 operates at 462.5 kc., and oscillator 17 at 467.5 kc. Consequently, each of the I. F. signals can be demodulated independently. Since, as above described, the lowest best note resulting from the combinations of both radiated and received carriers is 2000 C. P. S., the beat oscillator frequencies are chosen so that the receiver outputs from both branches in the audio-frequency spectrum lie below 2000 C. P. S. Thus, with the mentioned I. F. of 465 kc., one branch will produce in the receiver an I. F. lying between 463.5 kc. and 464 kc. Consequently, in conjunction with the beat frequency of 462.5 kc., the output of the first branch will lie between 1000 and 1500 C. P. S. Likewise, the beat frequency of 467.5 kc., in the second branch causes the audio-frequency output of that branch to lie between 1000 and 1500 C. P. S. Preferably, the audio-frequency output of each branch is passed through a respective band-pass filter 18, 19, each having a band pass of 1000 to 1500 C. P. S. The filtered audio-frequency output in each branch can then be used to control suitable respective telegraph and facsimile reproducers 20, 21, in known manner.

While in the foregoing, it has been stated that the shifts of oscillators 2 and 4 are respectively 500 C. P. S., that represents the preferred upper limit of frequency shift. If desired, any smaller amount of shifts may be employed. Furthermore, while a system is employed using two separate carrier oscillators, it will be understood that a greater number may be employed. Thus each carrier shift oscillator may be shifted a maximum of 100 C. P. S. For example four separate oscillators may be employed, one variable between 15638.5 kc. and 15638.6; another between 15638.8 and 15638.9 kc.; another between 15641.1 kc. and 15641.2 kc.; and a fourth between 15641.4 kc. and 15641.5 kc. Each of these separate oscillators will then be controlled as to its shifted frequencies in accordance with a separate message transmitter. At the receiver the respective shifted carriers are demodulated to derive the respective signals in each of four channels similar to those described in connection with channels 1 and 2.

Various changes and modifications may be made in the disclosed embodiment without departing from the spirit and scope of the invention.

What is claimed is:

1. The method of operating an existing radio transmitter to increase its service usefulness, which comprises simultaneously feeding the transmitter with radio frequency oscillations from at least two separate channels, shifting under

control of one kind of signal the frequency in one channel between predetermined frequency limits, shifting under control of a different kind of signal the frequency in the other channel between predetermined frequency limits, the actual frequency difference between the two channels being in the audio frequency range and whose mean frequency is substantially the same as the normal assigned service frequency of the radio transmitter.

2. The method of operating an existing radio transmitter to increase its service usefulness, which comprises simultaneously exciting the transmitter with two separate radio frequencies, shifting the frequency of one of said exciting frequencies from one limit to another limit corresponding to different signal conditions e. g. "mark" and "space," shifting the frequency of the other exciting frequency from one limit to another limit corresponding to other signal conditions e. g. "black" and "white," one of said frequency shifts being below the normal assigned service frequency of the transmitter and the other frequency shift being above the normal assigned service frequency of the transmitter.

3. The method of operating an existing radio transmitter to increase its service usefulness, which comprises generating a first pair of audio frequency signals whose frequency difference is F_a , generating a second pair of audio frequency signals whose frequency difference is also F_a , shifting the frequency of a first radio oscillator under control of said first pair of signals and between frequency limits F_1 and F_2 where $F_2 - F_1$ equals F_a , shifting the frequency of a second radio oscillator under control of said second pair of signals and between frequency limits F_3 and F_4 where $F_4 - F_3$ equals F_a , and simultaneously applying both shifted frequency oscillator outputs to a radio transmitter whose normal assigned service frequency is the mean between F_1 and F_4 .

4. In a radio system, a plurality of separate radio frequency oscillation sources a radio transmitter having an assigned normal service frequency F , means to simultaneously excite the transmitter with radio frequency oscillations of different frequency ranges originating from said separate sources, means to shift the frequency of one source under control of a first signal, means to shift the frequency of the other source under control of another signal, the mean frequency of said shifted frequencies being approximately the said normal service frequency, and a common antenna upon which both shifted frequencies are impressed.

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