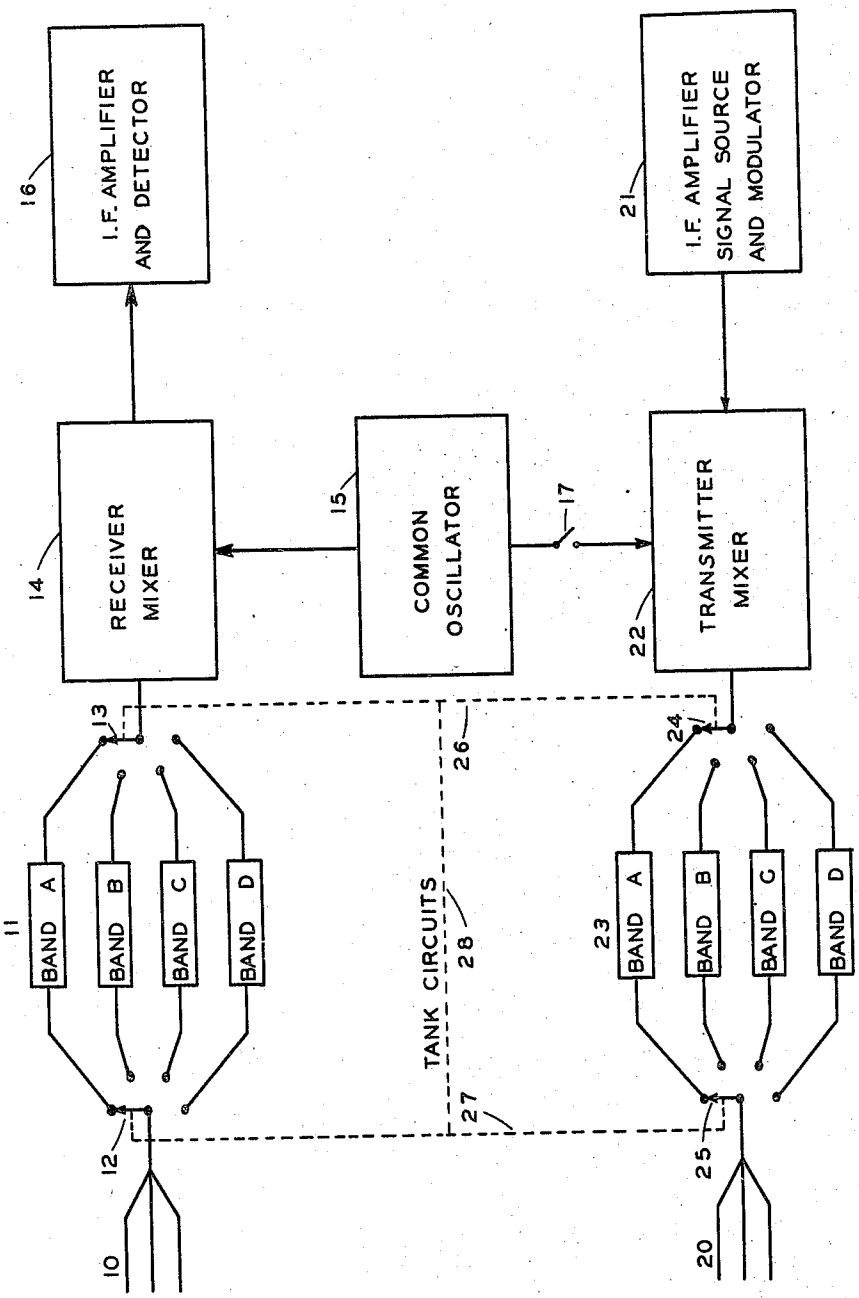
Aug. 17, 1948. J. F. BYRNE 2,447,392

SYSTEM FOR ALIGNING RECEIVER AND TRANSMITTER CIRCUITS

Filed May 23, 1945



INVENTOR.
JOHN F. BYRNE

BY
William D. Hall
ATTORNEY

Patented Aug. 17, 1948 2,447,392

UNITED STATES PATENT OFFICE

2,447,392

SYSTEM FOR ALIGNING RECEIVER AND TRANSMITTER CIRCUITS

John F. Byrne, Wellesley Hills, Mass., assignor to the United States of America as represented by the Secretary of War

Application May 23, 1945, Serial No. 595,353

1 Claim. (Cl. 250—13)

1

The present invention relates in general to electric circuits and more particularly to a novel arrangement of a radio transmitter and receiver.

The invention comprises a superheterodyne receiver and a transmitter, the output frequency of which is determined by a variable frequency oscillator which is common to both receiver and transmitter. The use of a common oscillator to determine the output frequency of the transmitter makes it certain under all conditions that the frquency of the transmitter is the same as that to which the receiver is tuned; that is, the incoming signal frequency.

One of the advantages of the present invention is that an operator receiving signals on the receiver may transmit a signal back to the sender merely by turning on the power circuits of the transmitter without any further adjustment, since the common oscillator permits the simultaneous tuning of the receiver and transmitter to a single frequency.

The range of frequencies that can be covered by a receiver or transmitter having single tuning circuits in which a desirable sensitivity in the case of a receiver, and effective transmitting range in the case of a transmitter are maintained, is limited by practical considerations in the design of their circuits. Accordingly, in the present invention when it is desired to cover a broad range of frequencies, there are provided separate tank circuits for several bands of frequencies within the entire range covered. The common oscillator is designed to be tunable over a band greater than the width of the band covered by the individual tank circuits.

Other objects, features and advantages of this invention will suggest themselves to those skilled in the art and will become apparent from the following description of the invention taken in connection with the accompanying drawing which is a block diagram showing the preferred embodiment of the invention.

Incoming signals are received on the receiving antenna 10 and passed through one of the receiver tank circuits 11 which has been chosen by the operator as the tank circuit proper to cover the band of frequencies in which the received signal is found. The selection of the proper tank circeived signal is found. The selection of the proper tank circuit is made by switches 12 and 13. The signal then passes into the mixer section 14 of the receiver where it is combined with oscillations produced by the tunable oscillator 15, resulting in an intermediate frequency which in the remaining parts 16 of the receiver is amplified and

2

detected in a conventional manner. The oscillator 15 is tunable manually over a band of frequencies which is greater in width than the band of frequencies covered by the tank circuits A, B, C, and D, generally designated as 11.

It is contemplated that during the operation of the receiver all of the circuits of the transmitter will be energized with the possible exception of the final power consuming load circuits such as the antenna and tank circuits. With the switch 17 open no oscillations are fed into the transmitter from the oscillator; therefore, no energy can be radiated from the transmitter antenna 20. However, all the circuits of the transmitter are tuned and put into condition so that when the switch 17 is closed the transmitter will transmit a wave of the same frequency as that to which the receiver is tuned. This is accomplished as follows: The frequency to which the transmitter intermediate frequency circuits 21 are tuned is the same as that to which the receiver intermediate frequency amplifier circuits are tuned. The result is that when oscillations from this amplifier 21 are mixed with oscillations from the oscillator 15 in the transmitter mixer 22, signals of the difference frequencies are introduced into one of the transmitter tank circuits 23. A transmitter tank circuit covering the same band of frequencies as that covered by the receiver tank circuit, which is connected in the receiver, is chosen and connected into the circuit by means of the switches 24 and 25. Switch 24 is mechanically linked by any well known means, shown diagrammatically as 26, to the switch 13, and switch 25 is similarly linked by 27 to switch 12. Likewise, the two sets of switches operate simultaneously by means of a mechanical linkage 28.

It is well known that if two frequencies, A and B, are mixed in accordance with the superheterodyne principle that there are two resulting frequencies, A+B and A—B. It is common practice to choose in a receiver the A—B frequency for further amplification and detection and to include means in a receiver for rejecting the A+B, or image, frequency. In the arrangement of the present invention, since the intermediate frequency of the transmitter and receiver are the same, it is desired in the transmitter mixer 22 to select the A+B frequency in order to have the output of that section be of the same frequency as the frequency of the signal being received by the receiver. Accordingly, filter means are provided in the transmitter mixer 22 to remove the A—B frequency, which in that case becomes the image frequency. Such means are well known

and may be of conventional design; therefore, no description of them is needed in this present specification.

While there has been here described what is at present considered to be the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention.

What is claimed is:

A radio signal system comprising a receiver circuit, a transmitter circuit and a tunable oscillator common to both circuits, said receiver circuit comprising an antenna, a plurality of band pass radio frequency circuits, the aforesaid common oscillator, a mixer stage connected to receive the output of said radio frequency circuits and the output of said common oscillator to produce an intermediate frequency representing the difference frequency between a received frequency and the common oscillator frequency, means to suppress the frequency which is the sum frequency of the received frequency and the common oscillator frequency, and means to amplify and detect the intermediate frequency; said transmitter circuit comprising an oscillator to produce a signal having a frequency equal to the intermediate frequency produced in the receiver circuit, means to amplify said signal and means to modulate said signal, the aforesaid common

oscillator, a mixer stage connected to receive the output of said signal oscillator, said amplifier and modulator means and said common oscillator to produce a signal representing the sum frequency of the intermediate frequency and the oscillator frequency, means to suppress the difference frequency representing the difference between the common oscillator frequency and the intermediate frequency, a plurality of band pass radio frequency circuits, each designed to cover the same band of frequencies covered by the band pass circuits in the receiver, and common means for selecting in the receiver circuit and in the transmitter circuit matched band pass circuits whereby said transmitter is always tuned to the same frequency as said receiver input circuits.

JOHN F. BYRNE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,113,419	Young	Apr. 5, 1938
Re. 21,955	Chaffee	Nov. 25, 1941
2,317,547	McRae	Apr. 27, 1943
2,402,606	Davis	June 25, 1946
2,408,826	Vogel	Oct. 8, 1946