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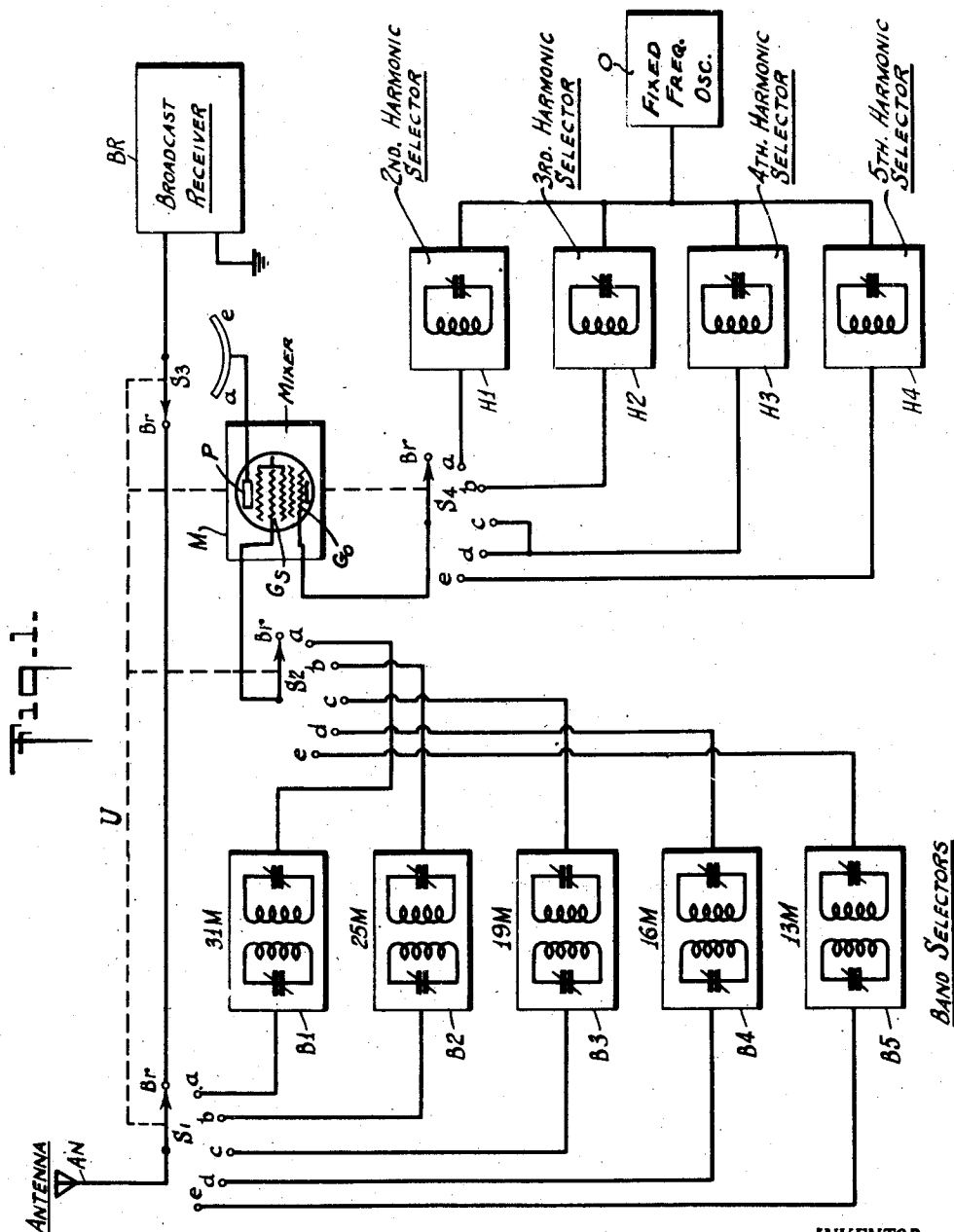
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MULTIBAND RECEIVER WITH BAND SPREAD

Filed July 25, 1942

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 2.

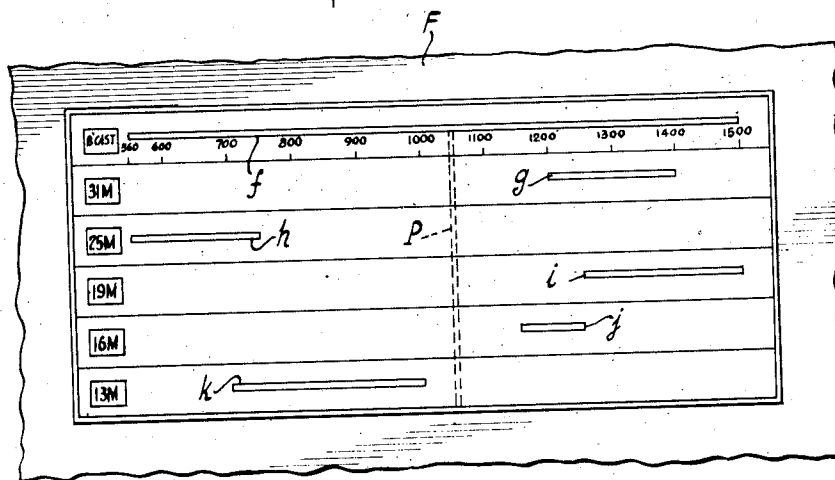
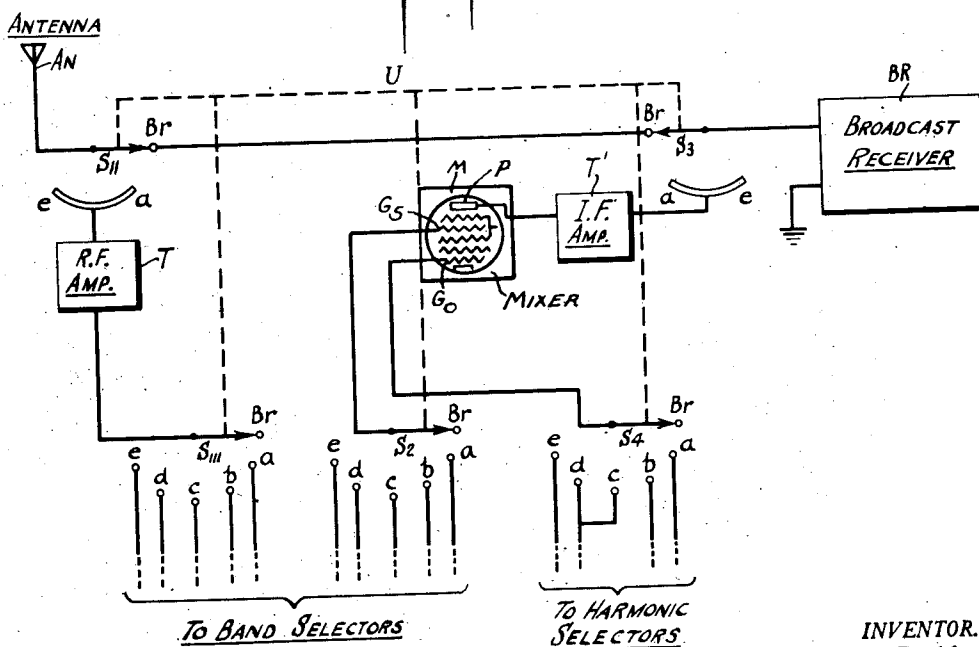


Fig. 3.



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MULTIBAND RECEIVER WITH BAND SPREAD

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7 Claims. (Cl. 250-20)

The present invention relates in general to multi-band receivers with band spread.

More particularly, it relates to a multi-band receiver in which the portion of the receiver utilized for the reception of the broadcast band is operative also in a plurality of the short wave bands, the same tuning control being effective to tune in the latter bands, the dial calibrations of which extend over wider ranges to permit more accurate adjustment.

In present day spread-band receivers the heterodyne oscillator must be operated at high frequencies so that a small percent change in frequency results in the tuning drifting away from the signal. Also, extreme vernier action is necessary to tune in the signals, and dial calibrations are apt to be inaccurate.

In the system according to the invention, the broadcast band reception of the receiver is retained, the signal being heterodyned with a fixed frequency oscillator, so that the resultant difference frequency falls within the broadcast band. By tuning the broadcast receiver, the desired band can be covered, with approximately the correct tuning ratio and dial calibration.

For example, a single oscillator frequency can be used for two bands, such as the 31 and 25 meter bands. Thus a fixed oscillator at 10,500 kc. would heterodyne with the 31 meter band (9500 to 9700 kc.) so that the broadcast receiver would be tuned from 800 kc. to 1000 kc. to cover the band, while the 25 meter band (11,700 kc. to 11,900 kc.) would require the broadcast receiver to be tuned from 1200 kc. to 1400 kc. to cover the band.

By using harmonics of a fixed oscillator having a fundamental frequency of approximately 4.15 mc., the oscillator being preferably crystal-controlled, five spread bands can be received. The method of using such an oscillator is shown in the following table and will be explained hereinafter. Because of the resulting higher heterodyned frequency, the image response is reduced over the usual method of heterodyning directly to 455 kc.

Band	Frequency range	Harmonic No. of osc.	Harmonic freq.	Heterodyned band freq.
	Mc.		Mc.	Kc.
31 m.	9.5 - 9.7	2	8.3	1,200-1,400
25 m.	11.7 - 11.9	3	12.45	750- 550
19 m.	15.1 - 15.35	4	16.6	1,500-1,250
16 m.	17.75-17.85	4	16.6	1,150-1,250
13 m.	21.45-21.75	5	20.75	700-1,000

Because the high frequency oscillator is fixed in frequency, it can be made very stable by temperature compensation, crystal control, or other means in a known manner.

It is therefore one of the objects of the present invention to improve the stability and ease of tuning spread-band receivers.

Another object of the invention is to provide a single oscillator frequency for use with two bands.

Another object is the use of a fixed oscillator having a fundamental frequency of approximately 4.15 mc.

Still another object is to provide a receiver which will permit push-button tuning of short wave stations.

Still another object is the provision of mechanism for selectively illuminating the scale calibration which is being used.

Other objects are to improve generally the simplicity and efficiency of spread band receivers and to reduce their cost, so that not only would they be reliable in operation but capable also of economical manufacture and assembly.

The novel features characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and mode of operation together with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawings in which

Fig. 1 illustrates in diagrammatic fashion the circuit of a multi-wave spread band receiver according to the invention; Fig. 2 is a view in elevation of the form of tuning dial that may be used with the receiver of the invention; and Fig. 3 is a circuit similar to that of Fig. 1 but including certain modifications.

Referring now particularly to Fig. 1 the block BR represents a broadcast receiver which may be of the tuned radio frequency or super-heterodyne type, tunable through the broadcast band 550 to 1550 kc. The antenna terminal of this receiver is connected to the antenna An through the switches S₃ and S₁ when in the position shown, in contact with the respective terminals Br, for operation in the broadcast band.

Band selectors B1 to B5 designed to accept respectively the 31, 25, 19, 16 and 13 meter bands have their inputs connected respectively to the contacts a to e of the switch S₁. The band selectors may each comprise a pair of fixed tuned circuits designed to permit the transmission, more or less uniformly, of the entire band of fre-

quencies allocated to the respective short wave bands.

A fixed frequency stable oscillator O has coupled to its output a plurality of harmonic selectors H1, H2, H3 and H4 which are adjusted to select respectively the 2nd, 3rd, 4th and 5th harmonics of the fundamental frequency of the oscillator. The outputs of harmonic selectors H1, H2 and H4 are connected respectively to the switch terminals a, b and c of the switch S4, the output of the harmonic selector H3 being connected to the two switch contacts c and d.

The movable blades of the switches S2 and S4 are connected respectively to the signal control grid Gs and the oscillator grid Go of a frequency mixer or converter M, the output or anode electrode P of which is connected to the fixed contact strip a—e of the switch S3, so that in any position of the switch S3, except that for the broadcast band, the resulting beat frequency will be impressed upon the broadcast receiver input. The several switches S1 to S4 are controlled in unison as diagrammatically shown by the dash line U. Switches S2 and S4 each have a dead contact Br with which the movable blades of the switches make contact when the system is adjusted for reception in the broadcast band. In the a-position of the several switches, the antenna is disconnected from the broadcast receiver input and the system will be operative to receive signals in the 31 m. band, the second harmonic selector H1 being effective in this band. In the b-position of the switches the system will be operative to receive signals in the 25 m. band, the third harmonic selector H2 being effective for this band. In the c-position of the switches the system will be operative to receive signals in the 19 m. band and in the d-position the system will be operative to receive signals in the 16 m. band, the fourth harmonic selector H3 being effective for these two bands. In the e-position of the switches the system will be operative to receive signals in the 13 m. band and the fifth harmonic selector H4 will be effective.

In Fig. 2 there is shown in the front panel F of the receiver the tuning dial calibrations f, g, h, i, j and k for the broadcast band and the 31, 25, 19, 16 and 13 meter band, respectively. The common index pointer P is adapted to be movable over the several scales, being under the control of the manual tuning member of the broadcast receiver in the usual manner. If the broadcast receiver is of the push-button type, the push-buttons may be set up to receive stations in any of the short wave bands without any change whatever.

In order that the operator may not be confused as to which band is being received, it is another feature of the invention to operate the dials or dial lighting when the band switch is operated, so as to turn out the broadcast dial calibration and turn on the band spread calibration which is to be used. This arrangement is superior to the present practice of covering more range than is necessary, in order to keep the inaccuracies of calibration from showing up too much on the dial.

The system disclosed in Fig. 3 is similar to that shown in Fig. 1 except that a common RF amplifier tube T serves to amplify the incoming signal and is switched simultaneously with the other switches to the inputs of the several band selectors. If desired a tube T' may be coupled to the output of the mixer M for ob-

taining increased amplification of the intermediate frequencies prior to their transmission to the broadcast receiver. In other respects the operation of the system disclosed in Fig. 3 is identical with that of Fig. 1.

The system above described is desirable from a production standpoint because the conventional broadcast receiver can be used with little alteration. It is advantageous in auto and portable receivers, because the short wave tubes can be turned off to save power when only broadcast reception is desired. Also, when tuned in by push-button, if a very stable 4.15 m. c. oscillator has been used, the stability will give accurate tuning, which will not drift any more than the broadcast receiver does on broadcast signals. Because of the fixed tuning of the band selectors, and the higher image frequency separation, improved image attenuation ratios can be economically secured by designing the filters to have attenuation points at the desired frequencies.

While there have been shown and described certain preferred embodiments of the invention, it will be understood that modifications and changes may be made without departing from the spirit and scope of the invention, as will be understood by those skilled in the art.

What I claim is:

1. The method of effecting band spread tuning of a plurality of short wave bands utilizing a receiver adapted for broadcast reception, which consists in selectively receiving the entire range of frequencies in any one of the short wave bands, locally producing a fixed fundamental and a plurality of distinct harmonic frequencies thereof, mixing the received frequencies in each of the selected ranges with a predetermined harmonic of the locally-produced fixed frequency to obtain a band of intermediate frequencies which is different for the several bands and which falls within the range of the broadcast band frequencies, and tuning the broadcast receiver through said several bands of intermediate frequencies.

2. In a multi-band receiver adapted to receive a plurality of short wave bands, means for effecting band spread tuning in said bands, comprising a conventional receiver adapted for broadcast reception, means for selectively receiving the entire range of frequencies in any one of the short wave bands, a fixed frequency oscillator provided with a plurality of output circuits each tuned to a different harmonic of the fundamental oscillator frequency, means for mixing the received frequencies in each of the selected ranges with a selected one of said harmonic frequencies to obtain a band of intermediate frequencies which is different from the several bands and each falls within the range of the broadcast band frequencies, and means for tuning the broadcast receiver through said several bands of intermediate frequencies.

3. A system for the selective reception of signals in the broadcast band and in a plurality of short wave bands, comprising a source of signals, a receiver adapted to receive signals in the broadcast band only, a plurality of band selectors each adapted to accept one of the short wave bands, a local oscillator provided with a plurality of output circuits each tuned to a different harmonic of the fundamental oscillator frequency, means for selectively heterodyning the output frequencies of any one of the band selectors with a predetermined harmonic of the local oscillator frequency, and means for selectively connecting the

signal source directly to the broadcast receiver or to said receiver through any one of the band selectors and the heterodyning means.

4. A system for the selective reception of signals in the broadcast band and in a plurality of short wave bands, comprising a source of signals, a receiver adapted to receive signals in the broadcast band only, a plurality of band selectors each adapted to accept one of the short wave bands, a fixed frequency local oscillator, a plurality of harmonic selectors coupled to the output of said oscillator, means for selectively heterodyning the output frequency of a selected one of the band selectors with the output frequency of a selected one of the harmonic selectors, and means for selectively connecting the signal source to the broadcast receiver directly or through a selected one of the band selectors and a selected heterodyning means.

5. A multi-band receiver for the reception of signals in the broadcast band and a plurality of short wave bands, comprising a source of signals, a plurality of band selectors each adapted to transmit the entire band of frequencies contained in one of the short wave bands, means for selectively connecting the source of signals to the input of one of the band selectors, a fixed frequency oscillator, a plurality of harmonic selectors adapted to derive from said oscillator predetermined harmonics, a frequency converter, means for selectively connecting to the frequency converter the output of a predetermined band selector and the output of a predetermined harmonic selector for obtaining in each case a band of intermediate frequencies which is different from the other intermediate frequency bands, the several intermediate frequency bands occupying different portions of the broadcast band of frequencies, a receiver tunable over the broadcast band, and means for selectively connecting the broadcast receiver input to the source of signals or to the output of the frequency converter.

6. A multi-band receiver for the reception of signals in the broadcast band and in at least one of the 13, 16, 19, 25 and 31 meter bands, comprising a source of signals, a plurality of band selectors, one for each band, adapted to transmit the entire band of frequencies allocated to each band, means for selectively connecting the source of signals to the input of one of the band selectors, an oscillator adapted to generate a fixed frequency of approximately 4.15 mc., a plurality of harmonic selectors adapted to derive from said oscillator second, third, fourth and fifth harmonics, a frequency converter, means for selectively connecting to the frequency converter the outputs of the 31 meter band selector and the second harmonic selector, or the 25 meter band selector and the third harmonic selector, or the 19 meter band selector and the fourth harmonic selector, or the 16 meter band selector and the fourth harmonic selector, or the 13 meter band selector and the fifth harmonic selector, for obtaining in each case a band of intermediate frequencies which is different from the other intermediate frequency bands, the several intermediate frequency bands occupying different portions of the broadcast band of frequencies, a receiver tunable over the broadcast band, and means for selectively connecting the broadcast receiver input to the source of signals or to the output of the frequency converter.

7. A multi-band receiver in accordance with the invention defined in claim 6, wherein the plurality of band selectors is provided with a common radio frequency amplifier, the output of which is selectively connected to one of the band selectors and the input of which is connected to the signal source only when the receiver is adjusted for reception in the short wave bands.

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