

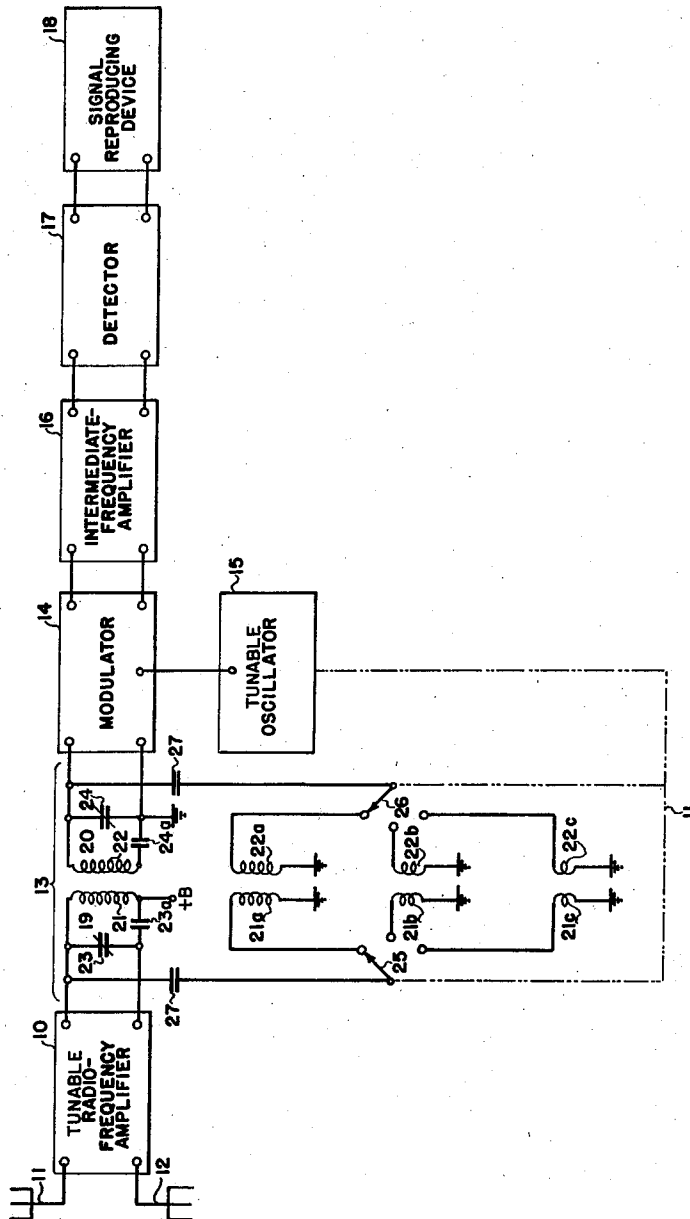
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TUNABLE BAND-PASS SELECTOR

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TUNABLE BAND-PASS SELECTOR

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This invention relates to tunable band-pass selector systems and more particularly to an arrangement for adjusting the mean resonant frequency of such systems while maintaining the band of frequencies passed thereby of substantially constant width and symmetrical relative to its mean frequency.

While the invention is of general application, it is especially adapted for use as a tunable selector system for sound and television wave-signal receivers.

Optimum fidelity of reproduction consistent with the avoidance of interference from stations operating on adjacent carrier frequencies and from static and other signal disturbances is obtainable by the provision of selector circuits designed to pass only the desired band of modulation frequencies, thereby to provide the required selectivity, which band is symmetrical relative to the mean resonant frequency to which the system is tuned. While selector systems may be readily designed to pass such a band of frequencies when tuned to a given mean resonant frequency for the reception of a given carrier wave or waves, a problem is presented when it is desired to tune such systems to other mean resonant frequencies for the reception of carrier waves of widely different frequencies. The necessary adjustment of the self-reactances of the tunable circuits for the purpose of tuning such systems ordinarily undesirably affects the width and symmetry of the pass band of the system.

It is an object, therefore, of the present invention to provide an improved tunable band-pass selector system whereby the mean resonant frequency of the system may be adjusted over a wide range of frequencies while the band of frequencies passed thereby is maintained of substantially constant width and symmetrical relative to any mean resonant frequency to which the system is adjusted.

In accordance with the present invention, there is provided a tunable band-pass selector system which comprises primary and secondary tuned circuits. These circuits include main reactive coupling means which may, for example, comprise inductively coupled inductance elements. The system further includes means for adjusting the mean resonant frequency thereof while maintaining the band of frequencies passed thereby of substantially constant width and symmetrical relative to its mean resonant frequency. This means comprises adjustable auxiliary reactive coupling means including coupled primary and secondary reactance elements, for example, in-

ductively coupled primary and secondary inductance elements, and means for selectively connecting the auxiliary primary and secondary elements in circuit with the primary and secondary tuned circuits, respectively, to adjust the self-reactances of the circuits. Preferably the auxiliary primary and secondary reactance elements are connected in parallel with the main primary and secondary reactive coupling elements, respectively, of the tuned circuits. This connection serves to adjust both the self-reactance of the circuits, and hence to adjust the mean resonant frequency of the system, and the coupling between the primary and secondary circuits. The self-reactances and coupling provided by the auxiliary coupling means is so related to the self-reactance and coupling provided by the main coupling means that the frequency band is maintained of substantially constant width and symmetrical with respect to any mean resonant frequency of the system as it is adjusted in frequency over its tuning range.

In a preferred embodiment of the invention, the system includes a plurality of pairs of auxiliary coupling elements and unicontrol means for selectively connecting the auxiliary primary and secondary elements of the several pairs in circuit with the primary and secondary tuned circuits, respectively. The self-reactances of the auxiliary elements are so proportioned that, as the successive pairs of coupling elements adjust the mean resonant frequency of the band passed by the system to successively higher frequencies, the resultant coupling between the primary and secondary circuits progressively decreases and is so related to the resultant self-reactances of the circuits that the frequency band is maintained of constant width and symmetrical as described above.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the accompanying drawing, the single figure is a circuit diagram, partially schematic, of a complete modulated-carrier signal receiver embodying a preferred form of the present invention.

Referring in detail to the drawing, the invention is here illustrated as employed in connection with a superheterodyne wave-signal receiver, those parts of the receiver which are well known and do not comprise any part in the present in-

vention being indicated schematically. The receiver comprises a tunable radio-frequency amplifier 10 having its input circuit connected to an antenna system 11, 12. Connected in cascade 5 to the output circuit of the amplifier 10, in the order named, are a radio-frequency band-pass selector system 13, which embodies the present invention and will be hereinafter described in detail, a modulator 14 having an oscillator 15 10 connected thereto in a conventional manner, an intermediate-frequency amplifier 16, a detector 17 and a signal-reproducing device 18.

Neglecting for the moment the selector system 13, per se, the system described above comprises 15 a conventional superheterodyne receiver, the operation of which is well understood in the art, so that a detailed explanation thereof is unnecessary. Briefly, signals intercepted by the antenna system 11, 12 are selected and amplified in the radio-frequency amplifier 10 and supplied by way of the selector system 13 to the 20 modulator 14 whereby the signals are converted to intermediate-frequency signals in the usual manner. The output of the modulator 14 is delivered to the intermediate-frequency amplifier 25 16 wherein the signal is further selected and amplified and from which it is delivered to the detector 17. The detector produces the signal-modulation voltages and supplies them to the 30 signal-reproducing device 18 wherein they are amplified and reproduced in a conventional manner.

Referring now more particularly to the selector system 13 which embodies the present invention, this system comprises a main selector including primary and secondary tuned circuits 19 35 and 20 comprising inductively coupled inductance elements 21 and 22, respectively, which are tuned to a given frequency by means of adjustably fixed condensers 23, 24 connected across the inductance elements 21 and 22 by way of blocking condensers 23a, 24a, respectively. The output 40 circuit of amplifier 10 is connected across the resonant circuit 19 while the input circuit of the modulator 14 is connected across the resonant circuit 20. These two resonant circuits, being identically tuned and reactively coupled, constitute a selector network and the width and symmetry of the frequency band-pass thereby, with 50 respect to the mean resonant frequency of the system, are dependent upon the coupling therebetween. The circuit constants are so adjusted as to pass a frequency band of the desired width and substantially symmetrical relative to the mean resonant frequency of the tuned circuits. 55

For the purpose of adjusting the tuning of the selector system 13, there is provided a plurality of pairs of auxiliary inductively coupled primary and secondary inductance elements 21a, 22a; 60 21b, 22b; and 21c, 22c. Switches 25 and 26, operated by a unicontrol element U, are arranged selectively to connect the auxiliary primary and secondary inductance elements of the several 65 pairs in parallel with the main inductance elements 21 and 22, respectively, through blocking condensers 27. The self-reactances of the auxiliary inductance elements 21a, 22a, etc., are so proportioned that the successive pairs of auxiliary coupling elements, when connected in 70 parallel with the main coupling elements, adjust the resultant self-reactances of the resonant circuits 19 and 20 so as to adjust the mean resonant frequency of the band passed by the system to successively higher frequencies. Moreover, the 75 self-reactances and the coupling provided by

the auxiliary coupling elements of each pair are so related to the self-reactance and coupling provided by the main inductance elements that the frequency band passed by the system is maintained of substantially constant width and 5 symmetrical with respect to any mean resonant frequency to which the system is adjusted. In the embodiment illustrated, the auxiliary elements of the several pairs are proportioned to adjust the resonant frequency of the band passed 10 by the system to successively higher frequencies and progressively to decrease the resultant coupling between the primary and secondary tuned circuits as successive pairs of elements are connected in circuit. 15

A selector system substantially identical to the system 13 is preferably included in the radio-frequency amplifier 10 and in the frequency-determining circuit of oscillator 15, and their auxiliary coupling elements are controlled by the unicontrol means U, as indicated in the 20 drawing, so that the amplifier 10, the selector 13, and the oscillator 15 may be tuned by a single control element, as in conventional practice.

While there has been hereinbefore described 25 what is at present considered to be the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made herein without departing from the invention, and it is, therefore, 30 aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A tunable band-pass selector system comprising primary and secondary tuned circuits including main reactive coupling means, and means 35 for adjusting the mean resonant frequency of said system while maintaining the band of frequencies passed thereby of substantially constant width and symmetrical relative to its mean frequency, comprising an adjustable auxiliary reactive 40 coupling network comprising reactively coupled primary and secondary circuits, and means for selectively connecting certain of said auxiliary primary and secondary circuits in circuit with 45 said main primary and secondary tuned circuits, respectively, to adjust the mean resonant frequency of the band passed by said system, the self-reactances and coupling provided by said auxiliary network being so related to the self-reactance and coupling provided by said main 50 coupling means that said frequency band is maintained of substantially constant width and symmetrical with respect to any mean resonant frequency to which said system is adjusted. 55

2. A tunable band-pass selector system comprising primary and secondary tuned circuits including main reactive coupling means, and means 60 for adjusting the mean resonant frequency of said system while maintaining the band of frequencies passed thereby of substantially constant width and symmetrical relative to its mean frequency, comprising adjustable auxiliary reactive coupling 65 means including reactively coupled primary and secondary elements, and means for selectively connecting certain of said auxiliary primary and secondary elements in circuit with said primary and secondary tuned circuits, respectively, to adjust the self-reactances of said circuits, thereby 70 to adjust the mean resonant frequency of the system, the self-reactances and the coupling provided by said auxiliary coupling means being so related to the self-reactance and coupling provided by said main coupling means that said fre- 75

quency band is maintained of substantially constant width and symmetrical with respect to any mean resonant frequency to which said system is adjusted.

5 3. A tunable band-pass selector system comprising primary and secondary tuned circuits including main coupled inductance elements, and means for adjusting the mean resonant frequency of said system while maintaining the band of frequencies passed thereby of substantially constant width and symmetrical relative to its mean frequency, comprising adjustable auxiliary inductively coupled primary and secondary inductance elements, and means for selectively connecting
10 certain of said auxiliary primary and secondary elements in circuit with said primary and secondary tuned circuits, respectively, to adjust the self-reactances of said circuits, thereby to adjust the mean resonant frequency of the system, the self-inductances and coupling provided by said
15 auxiliary elements being so related to the self-inductance and coupling provided by said main inductance elements that said frequency band is maintained of substantially constant width and symmetrical with respect to any mean resonant frequency to which said system is adjusted.

4. A tunable band-pass selector system comprising primary and secondary tuned circuits including main inductively coupled primary and secondary inductance elements, respectively, and means for adjusting the mean resonant frequency of said system while maintaining the band of frequencies passed thereby of substantially constant width and symmetrical relative to its mean frequency, comprising adjustable auxiliary inductive coupling means including inductively coupled primary and secondary inductance elements, and means for selectively connecting certain of said auxiliary primary and secondary elements in parallel with said main primary and secondary inductance elements, respectively, to adjust the self-reactances of said circuits, thereby to adjust the mean resonant frequency of the system, the self-inductances and coupling provided by said
40 auxiliary inductance elements being so related to the self-inductance and coupling provided by said main inductance elements that said frequency band is maintained of substantially constant width and symmetrical with respect to any mean resonant frequency to which said system is adjusted.
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5. A tunable band-pass selector system comprising primary and secondary tuned circuits in-

cluding main inductively coupled primary and secondary inductance elements, respectively, and means for adjusting the mean resonant frequency of said system while maintaining the band of frequencies passed thereby of substantially constant width and symmetrical relative to its mean frequency, comprising a plurality of pairs of auxiliary inductively coupled primary and secondary inductance elements, and means for selectively connecting the auxiliary primary and secondary inductance elements of any of said pairs in circuit with said primary and secondary resonant circuits, respectively, to adjust the self-reactances of said circuits, thereby to adjust the mean resonant frequency of the system, the self-inductances and coupling provided by said auxiliary elements of each pair being so related to the self-inductance and coupling provided by said main inductance elements that said frequency band is maintained of substantially constant width and symmetrical with respect to any mean resonant frequency to which said system is adjusted.

6. A tunable band-pass selector system comprising primary and secondary tuned circuits including main inductively coupled primary and secondary inductance elements, respectively, and means for adjusting the mean resonant frequency of said system while maintaining the band of frequencies passed thereby of substantially constant width and symmetrical relative to its mean frequency, comprising a plurality of pairs of auxiliary inductively coupled primary and secondary inductance elements, and means for selectively connecting the auxiliary primary and secondary inductance elements of successive pairs in circuit with said primary and secondary resonant circuits, respectively, the self-reactances of said auxiliary elements being so proportioned that said successive pairs adjust the mean resonant frequency of the system to successively higher frequencies, and the couplings between the elements of said successive pairs being so related to the coupling provided by said main inductance elements and to the self-reactances of the circuits as to provide a progressively decreasing resultant coupling between said primary and secondary circuits, whereby said frequency band is maintained of substantially constant width and symmetrical with respect to the mean resonant frequency to which said system is adjusted.

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