Oct. 15, 1935. K. POSTHUMUS ET AL 2,017,131

INTERMEDIATE FREQUENCY AMPLIFIER

Filed March 9, 1932

Fig. 1

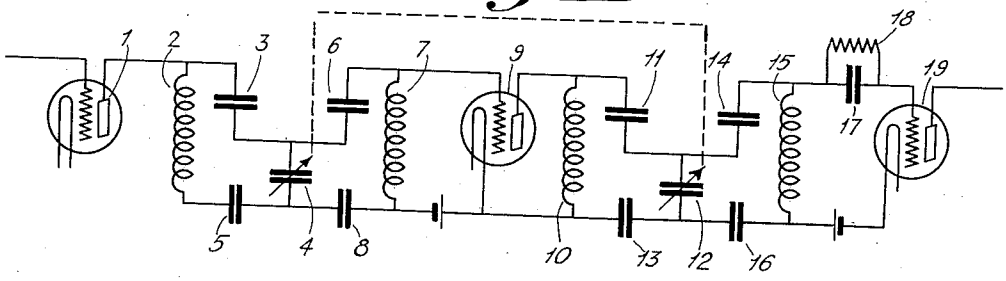


Fig. 2

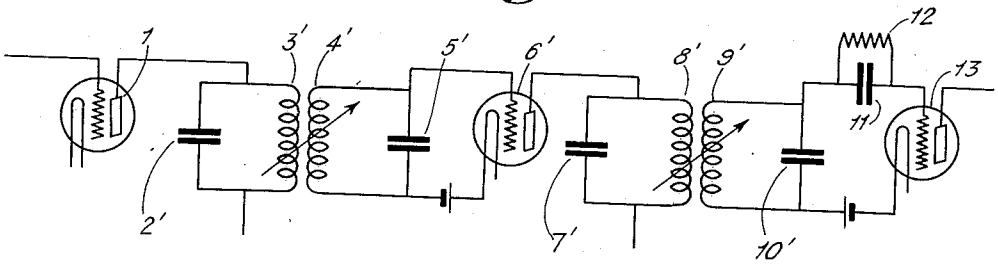
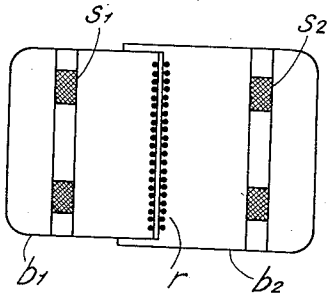


Fig. 3



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INTERMEDIATE FREQUENCY AMPLIFIER

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13 Claims. (Cl. 178—44)

The present invention relates to superheterodyne receivers, and more particularly to intermediate frequency amplifiers.

With heterodyne reception the selective medium or intermediate frequency amplifier is usually so arranged that a frequency range having a definite width is substantially evenly amplified, whereas all frequencies outside said range are suppressed. The width of this range must be so small that stations of about equal wave length do not disturb the reception and so great that the high music and speech frequencies are reproduced satisfactorily. Since both of these conditions cannot be complied with simultaneously, a compromise must be made. As a result of such compromise one is slightly annoyed by strong neighboring stations, while the quality of the sound reproduced is mediocre for all stations.

According to the present invention this drawback is avoided by providing a variable coupling between the tuning circuits of the medium frequency amplifier in such a manner that the resonance curve may be given either the shape of a sharp crest or that of a trapezium having steep upright sides, the first shape being obtained by coupling very loosely and the second by coupling closely.

Another object of the invention is to effect such a curve both with inductive coupling and with capacitive coupling of the circuits in a comparatively simple manner.

The novel features which we believe to be characteristic of our invention are set forth in particularity in the appended claims, the invention itself, however, as to both its organization and method of operation will best be understood by reference to the following description taken in connection with the drawing in which we have indicated diagrammatically several circuit organizations whereby our invention may be carried into effect.

In the drawing:

Fig. 1 is a diagram of an intermediate frequency amplifier circuit with a variable capacitive coupling.

Fig. 2 is a similar diagram with a variable inductive coupling.

Fig. 3 shows a form of construction of a tuned set of coils with variable coupling which may be used in the diagram of Fig. 2.

Referring to the accompanying drawing wherein like reference characters designate the same elements in the different figures, in Fig. 1 the anode 1 of the first detector valve is connected to a circuit tuned to the medium or intermediate frequency and consists of a coil 2 and condensers 3, 4 and 5 of which the condenser 4 is variable. This condenser serves for the coupling with the circuit 4, 6, 7, 8 comprised between grid and cathode of the medium frequency amplifier valve 9. In the same manner the anode circuit 10, 11, 12, 13 of the valve 9 is coupled with the grid circuit 12, 14, 15, 16 of the second detector tube 19 through the variable condenser 12. Detection is obtained by a grid condenser 17 together with the leakage resistance 18.

In addition to a modified coupling factor between the medium frequency circuits a variation of the condensers 4 and 12 entails a variation in the tuning of these circuits. However, this variation expressed in per cent is very small, and, moreover, it is substantially equal for all medium frequency circuits, especially when both condensers 4 and 12 are coupled together mechanically. Consequently an almost imperceptible modification of the tuning of the local high frequency generator is sufficient for making up for the variations in the medium frequency part of the arrangement.

The arrangement shown in Fig. 2 is distinct from that represented in Fig. 1 only in so far as the medium frequency circuits, 2', 3', with 4', 5' and 7', 8' with 9', 10', are coupled inductively in such a manner that the coupling factor is variable. This may be obtained in a simple manner by means of the coil construction shown in Fig. 3.

The coils S_1 and S_2 are provided in two telescoping metal screening cases b_1 and b_2 so that the mutual distance between the coils may be varied. Coil S_1 corresponds, of course, to coil 3' or 8', while coil S_2 corresponds to coil 4' or 9'. In order to prevent a capacitive coupling between the coils a frame aerial or shielding screen r is provided in the open end of the inner case b_1. The variable inductive coupling has the advantage over the capacitive coupling in that the tuning of the medium frequency circuits is less dependent on the coupling factor. On the other hand the variable capacitive coupling is to be preferred from a mechanical point of view.

While we have indicated and described several systems for carrying our invention into effect, it will be apparent to one skilled in the art that our invention is by no means limited to the particular organizations shown and described, but that many modifications may be made without departing from the scope of our invention as set forth in the appended claims.

What is claimed is:

1. An intermediate frequency amplifier network including at least two tuned circuits, each circuit including a coil and said coils being inductively coupled, means for adjusting the said coupling between said circuits in such a manner that the resonance curve of the network may be changed from one having a sharp crest to one having the shape of a trapezium with steep upright sides, said means including telescoping metal screening cases, and said coils being disposed within said cases.

2. An intermediate frequency amplifier network including at least two tuned circuits, each circuit including a coil and said coils being inductively coupled, means for adjusting the said coupling between said circuits in such a manner that the resonance curve of the network may be changed from one having a sharp crest to one having the shape of a trapezium with steep upright sides, said means including telescoping metal screening cases, and said coils being disposed within said cases and means for preventing capacitive coupling between said coils.

3. An intermediate frequency amplifier network including at least two tuned circuits, each circuit including a coil and said coils being inductively coupled, means for adjusting the said coupling between said circuits in such a manner that the resonance curve of the network may be changed from one having a sharp crest to one having the shape of a trapezium with steep upright sides, said means including telescoping metal screening cases, and said coils being disposed within said cases and means disposed between said coils for preventing capacitive coupling between said coils.

4. An intermediate frequency amplifier network including at least two tuned circuits, each circuit including a coil and said coils being inductively coupled, means for adjusting the said coupling between said circuits in such a manner that the resonance curve of the network may be changed from one having a sharp rest to one having the shape of a trapezium with steep upright sides, said means including telescoping metal screening cases, and said coils being disposed within said cases and metallic screen means for preventing capacitive coupling between said coils.

5. An intermediate frequency amplifier network including at least two tuned circuits, each circuit including a coil and said coils being inductively coupled, means for adjusting the said coupling between said circuits in such a manner that the resonance curve of the network may be changed from one having a sharp crest to one having the shape of a trapezium with steep upright sides, said means including telescoping metal screening cases, and said coils being disposed within said cases and means associated with at least one of the cases for preventing capacitive coupling between said coils.

6. An improvement in the intermediate frequency amplifier network of a superheterodyne receiver, which network includes at least one amplifier tube, a pair of tuned circuits, each fixedly resonant at all times to substantially the same operating intermediate frequency, coupled by an untuned common reactance, said improvement comprising means for adjusting the magnitude of said reactance to a value such that the resonance curve of the network has the shape of a sharp crest or to a value such that the curve has the shape of a trapezium having steep upright sides.

7. An improvement in the intermediate frequency amplifier network of a superheterodyne receiver, which network includes at least one amplifier tube, a pair of tuned circuits, each fixedly resonant at all times to substantially the same operating intermediate frequency, coupled by an untuned common reactance, each circuit including a coil, said improvement comprising means for adjusting the magnitude of said reactance, the said reactance consisting of mutual inductance between the coils of said tuned circuits, and said means comprising a device for producing relative movement between said coils.

8. In combination with a pair of resonant oscillation circuits, each including a coil and a capacity, a metallic receptacle housing said coils, said receptacle being constructed to produce relative motion between said coils.

9. In combination with a pair of resonant oscillation circuits, each including a coil and a capacity, both circuits being resonant to the same frequency, a metallic receptacle housing said coils, said receptacle being constructed to produce relative motion between said coils.

10. In combination with a pair of resonant-oscillation circuits, each including a coil and a capacity, a metallic receptacle housing said coils, a metal screen disposed between said coils to prevent capacity coupling between them, said receptacle being constructed to produce relative motion between said coils.

11. In combination with a pair of resonant oscillation circuits, each including a coil and a capacity, a metallic receptacle housing said coils, said receptacle being constructed to comprise a pair of telescoping portions, each portion housing one of the coils, said portions being movable to produce relative motion between said coils.

12. An improvement in the intermediate frequency amplifier network of a superheterodyne receiver, which network includes a second detector tube, a pair of tuned circuits immediately preceding the input electrodes of said tube, each of said tuned circuits being fixedly resonant at all times to substantially the same operating intermediate frequency, and said pair of circuits being coupled by an untuned common reactance, said improvement comprising means for adjusting the magnitude of the coupling reactance between said circuits to sharpen the shape of the network resonance curve to suppress interference due to strong undesired stations, and said means being additionally adjustable to broaden the shape of the said curve to reproduce substantially all the high modulations of the desired carrier frequency.

13. In combination in the intermediate frequency amplifier network of a superheterodyne receiver comprising at least one amplifier tube, a pair of coupled tuned circuits connected to the input electrodes of the tube and a second pair of coupled tuned circuits connected to the output electrodes of the tube, each of said pair of circuits being fixedly tuned to the operating intermediate frequency, and the coupling between the circuits of each pair of tuned circuits being an untuned common reactance, means for simultaneously adjusting the magnitudes of the said common reactances of both pairs of coupled tuned circuits, said means being adjustable to vary at will the selectively of the said network.

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