Feb. 7, 1933. F. L. ARLAND 1,896,993

RESONANT CIRCUIT

Filed May 14, 1929

Fig. 1.

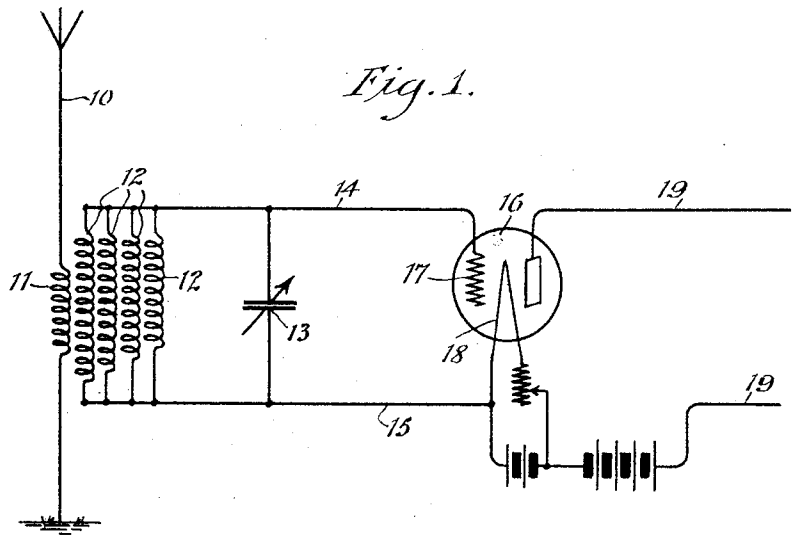



Fig. 2.

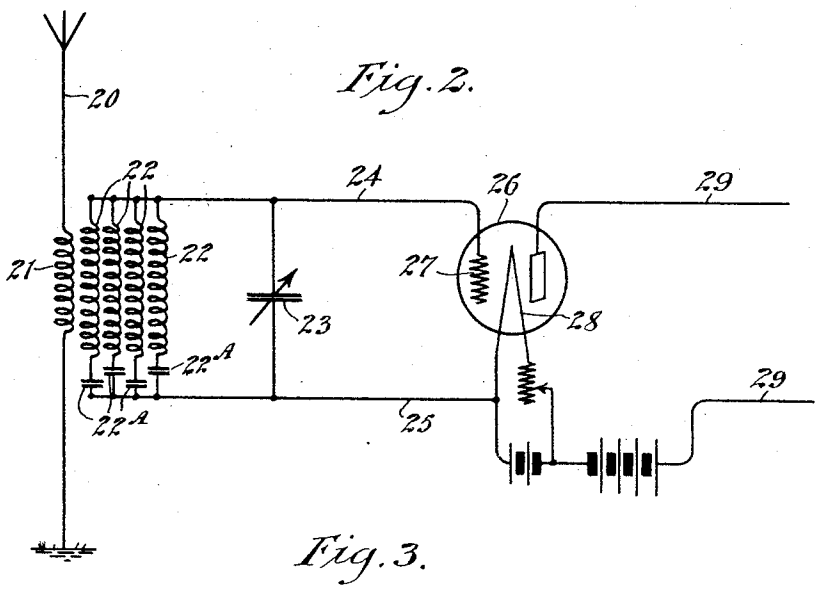
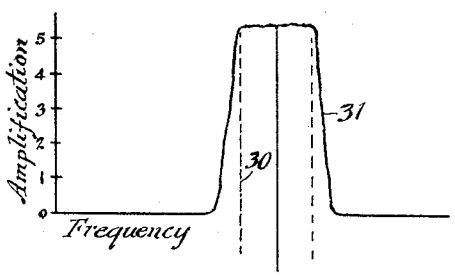



Fig. 3.




WITNESSES

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# UNITED STATES PATENT OFFICE

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## RESONANT CIRCUIT

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This invention relates to resonant circuits.

It is among the objects of the present invention to provide an improved resonant circuit adapted for use as a tuning circuit for the reception of Hertzian waves.

It is a further object of the present invention to provide a tuning circuit, the resonance curve of which will have a flat top, thus providing uniform amplification over a wide band.

It is a further object of the present invention to provide a radio frequency tuning circuit arranged for uniform transmission of a wide band of frequencies.

It is a further object of the present invention to provide a radio frequency tuning circuit which will uniformly amplify a band of frequencies of any desired width

It is also an object of the present invention to provide a novel method of obtaining a resonance curve having substantially flat tops.

Other objects and features of the present invention will be apparent from a consideration of the following specification taken in conjunction with the accompanying drawing, in which

Figure 1 is a diagrammatic illustration of one arrangement of the present invention;

Fig. 2 is a view similar to Fig. 1, of a different arrangement of the invention, and

Fig. 3 is an illustration of the resonance curve characteristic to circuits formed in accordance with the present invention.

Referring more particularly to the drawing, the invention has been illustrated in connection with a simple receiving circuit which has been illustrated as including a single thermionic relay. It will be understood, however, that the present invention is applicable to cascade amplification or in any type of radio or audio frequency work in which a resonant circuit is used.

Referring more specifically to Fig. 1 of the drawing, an antenna 10 has been provided having a primary transformer coil 11. Associated with the primary coil 11, a plurality of variously characterized secondary transformer coils 12 are provided arranged in parallel with a variable condenser 13. The coils 12 and condenser 13 are arranged between the conductors 14 and 15 to form a resonant circuit, the output of which is delivered to the usual thermionic relay 16, the conductor 14 being associated with a grid 17, while the conductor 15 is associated in the conventional manner with a filament 18. The vacuum tube is in the conventional manner associated with an output circuit which includes the conductors 19 associated with the grid and opposite side of the filament.

In considering the action of this form of the present invention, it will be understood that the device is arranged for the reception of radio carrier waves and the side bands which transmit the speech. In the conventional tuning circuits now in use, uniform amplification of the different side bands is difficult due to the fact that the circuit when tuned to the carrier frequency, offers less resistance to the side bands nearer the carrier wave than to those further remote therefrom. This lack of uniform amplification of all the side bands naturally prevents perfect reproduction.

With the use of the present invention, a plurality of secondary transformer coils having winding of slightly different impedance and tuned by the usual condenser 13, provide for simultaneous resonance at different frequencies, the arrangement being such that the effect is a plurality of tuning circuits all feeding into the grid 17 of the thermionic relay and each circuit by virtue of the tuning by the condenser 13 will be tuned in close harmony but in such variance that all the desired side bands will be faithfully amplified in the relay.

Referring more particularly to Fig. 2 of the drawing, the form of circuit here illustrated includes the antenna 20, primary transformer coil 21 and a plurality of secondary transformer coils 22. In this form of the invention the secondary coils 22 are of uniform impedance and characteristics, each of which is, however, associated with variously characterized fixed condensers $22^A$, which in combination with the variable condenser 23 and the conductors 24 and 25, provide a plurality of variously characterized

resonant circuits which may be simultaneously tuned for close resonance, whereby the effect as produced by that form of the invention shown in Fig. 1 will result. This circuit has been shown as including a thermionic relay 26, grid 27, filament 28 and conductors 29, all substantially as shown and described in connection with Fig. 1.

In connection with the present invention it will be understood that the invention is applicable in resonant circuits other than in the first tuning circuit of a radio receiver as here shown. Thus in tuned cascade amplification the primary or the secondary coil may be formed to provide the variously characterized resonant circuits.

It will further be understood that the invention is not confined to either specific type of circuit here shown but that other ways of providing for a single circuit responsive to a plurality of resonances may be formed. For instance, a single secondary coil may be associated with a plurality of variously characterized parallel inductances or capacities which will have the effect of producing a plurality of individual resonances for the circuit.

Referring more particularly to Fig. 3, the type of resonance curve for the circuit is here illustrated. Thus in a given place along the frequency line the resonances at that point will permit the passage of the wave of that frequency and thus the same may be amplified. In usual circuits, however, this curve converges rapidly toward a peak; thus as amplification increases faithful reproduction is lost as the side bands are not amplified because of their being cut off by the converging walls of the resonance curve. With the present circuit, however, it will be seen that the resonance curve has a substantially flat top and thus faithful amplification will be had over the whole height of the resonance curve. The perfect amplification curve is indicated in Fig. 3 by the dotted lines 30, while the experimental curve found by applicant is shown by the full lines 31.

From the foregoing it will be readily seen that the invention has provided a novel and improved resonant circuit, together with a novel method of securing the straight topped resonance curve. It will be understood that the invention is not confined to its application herein nor to the specific method of securing the wide amplification band. Thus in the formation of the invention, numerous changes and modifications and the full use of equivalents may be resorted to without departing from the spirit or scope of the invention as outlined in the appended claims.

What is claimed is:

1. A radio receiving circuit, including a primary transformer coil associated with the receiving aerial, and a plurality of secondary coils connected in parallel inductively related with said primary coil for selectively receiving from said primary coil one band of frequencies.

2. A radio receiving circuit, including a primary transformer coil associated with the receiving aerial, a plurality of secondary coils inductively related with said primary coil for selectively receiving from said primary coil one signal band of frequencies, said coils being arranged in parallel in a detector circuit and tuning means connected to the terminals of said secondary coils, said secondary coils and tuning means forming part of independent resonant circuits, each independent resonant circuit receiving a predetermined frequency band.

3. A radio receiving circuit, including a primary transformer coil associated with the receiving aerial, a plurality of secondary coils inductively related with said primary coil for selectively receiving from said primary coil one band of frequencies, said secondary coils being arranged in parallel in a detector and circuit, and a variable condenser arranged in said circuit parallel to all of said secondary coils.

4. A radio receiving circuit, including a primary transformer coil associated with the receiving aerial, a plurality of secondary coils inductively related with said primary coil for selectively receiving from said primary coil one signal containing a band of frequencies, said secondary coils being arranged in parallel in a detector circuit, and a tuning means arranged in said circuit parallel to all of said secondary coils, said secondary coils selectively forming part of independent resonant circuits including said tuning means, each independent resonant circuit receiving a predetermined frequency band.

5. A radio receiving circuit, including a primary transformer coil associated with the receiving aerial, a plurality of secondary coils inductively related with said primary coil for selectively receiving from said primary coil one signal containing a band of frequencies, said secondary coils being arranged in parallel in a detector circuit, and a variable condenser arranged in said circuit parallel to all of said secondary coils, said secondary coils selectively forming part of independent resonant circuits including said variable condenser, each of said secondary coils having a different impedance each of said independent resonant circuits receiving a predetermined frequency band.

6. An electrical circuit including a primary coil adapted to be connected with an aerial, a plurality of secondary coils in inductive relation to said primary coil, each secondary coil having a different impedance, a single variable condenser having its respective terminals connected across the respective

terminals of all of said secondary coils, and an output circuit connected to the terminals of said condenser said output circuit being connected to the respective terminals of said secondary coils and thereby forming with said condenser selectively independent resonant circuits, each independent circuit receiving an independent frequency band.

7. A radio receiving circuit, including a primary transformer coil associated with the receiving aerial, a plurality of secondary coils inductively related with said primary coil for selectively receiving from said primary coil one band of frequencies, said secondary coils being arranged in parallel in a detector circuit, and tuning means arranged in said circuit parallel to all of said secondary coils, said secondary coils selectively forming part of independent resonant circuits including said tuning means, each of said independent resonant circuits receiving a predetermined frequency band, said tuning means being operable to vary each of said independent resonant circuits to receive a signal of a particular frequency within the frequency band of each of said independent resonant circuits.

8. A radio receiving circuit including a primary transformer coil associated with the receiving aerial, a plurality of secondary coils inductively related with said primary coil for selectively receiving from said primary coil one band of frequencies, said secondary coils being arranged in parallel in an output circuit, and a variable condenser arranged in said output circuit parallel to all of said secondary coils, said secondary coils selectively forming a part of the independent resonant circuits, each of said independent resonant circuits receiving a predetermined frequency band.

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