Aug. 16, 1932. L. COHEN 1,872,246

RADIO SIGNALING

Filed July 23, 1928

Fig. 1.

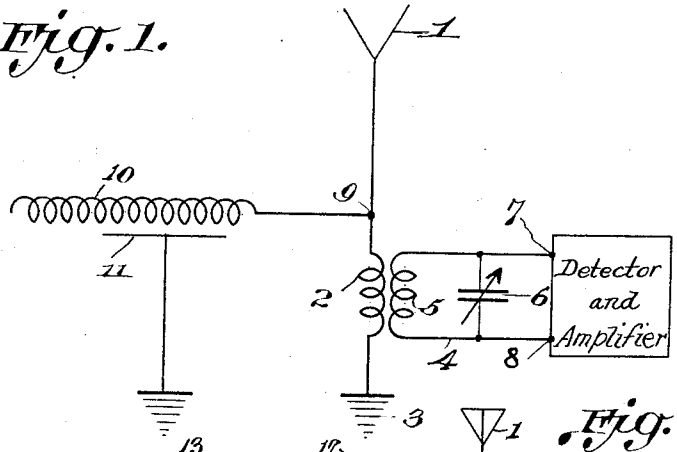


Fig. 3.

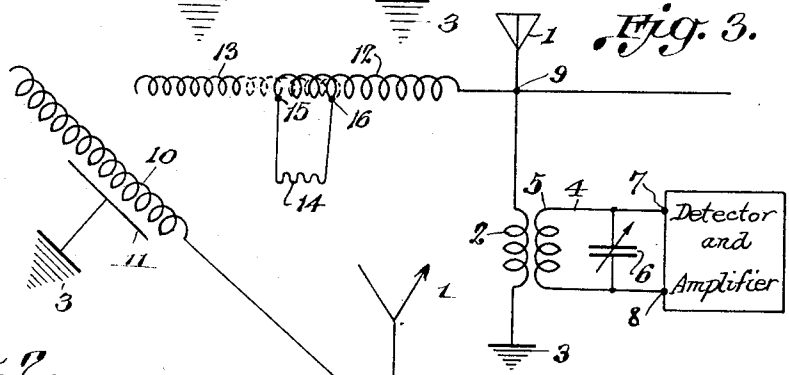
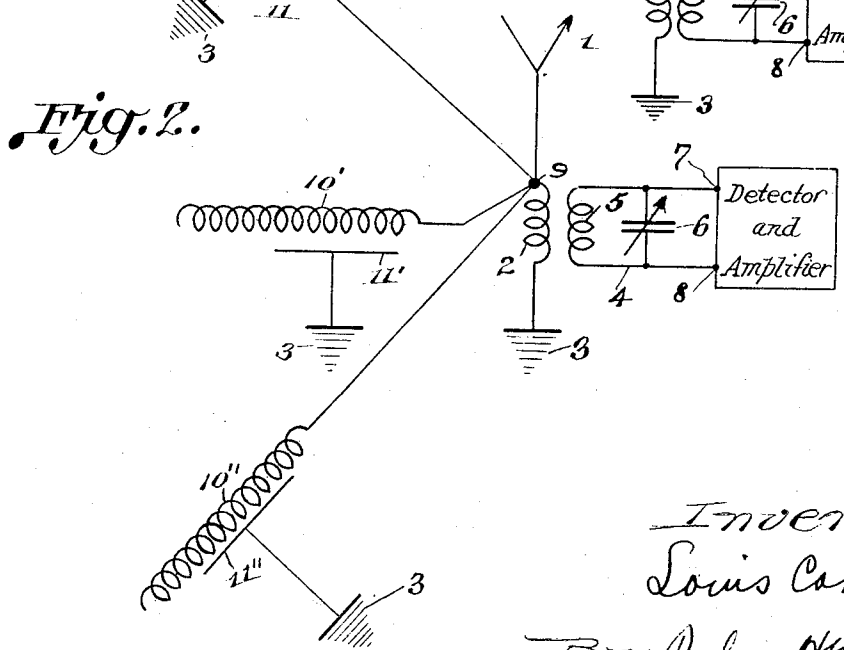


Fig. 2.



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UNITED STATES PATENT OFFICE

LOUIS COHEN, OF WASHINGTON, DISTRICT OF COLUMBIA

RADIO SIGNALING

Application filed July 23, 1928. Serial No. 294,742.

(GRANTED UNDER THE ACT OF MARCH 3, 1883, AS AMENDED APRIL 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to the art of radio signaling and particularly to improvements in receiving systems of radio signals.

One of the objects of this invention is to provide methods and means for the selective reception of radio signals; another object is to provide a method for the elimination of interfering signals of definite frequencies.

In the reception of radio signals much difficulty is experienced from interferences caused by any transmitting stations which may happen to be located in the vicinity of the receiver. Even if the frequencies of the local transmitters are different from the frequency of the signal to be received, the interferences may nevertheless be very serious if the frequencies of the interfering stations are not widely different from the frequency of the received signal. In the case of broadcast reception it is practically impossible to receive stations of frequencies which are close to the frequency of any local transmitting station which may be in operation, and that is true even for good selective receivers. With a sharply tuned receiver it may be possible to narrow the range of interfering frequencies, but whether the interference caused by a local transmitter covers a wide or narrow range of frequencies, the interference is there just the same and limits the usefulness of the receiver. For a locality where several transmitting stations are operating on different frequencies it makes it impossible to receive any distant station which may happen to be on a frequency somewhere within the range of any of the frequencies of the local transmitters, and thus preventing the reception of many stations.

It is the purpose of this invention to provide suitable methods and means for the elimination of interferences caused by local transmitters, and this is accomplished by the use of a circuit arrangement whereby the interfering signals of particular frequencies are by-passed or absorbed in an auxiliary circuit of distributed inductance and capacity and thus preventing these interfering signals from acting on the receiver.

The principle embodied in this invention is fundamentally the same as that covered in my co-pending patent applications, Serial Number 233,919 filed November 17, 1927 and Serial Number 293,608 filed July 18, 1928 in which applications I have discussed a new method for selective tuning which consists in the use of a wave conductor interposed between the antenna and the receiving circuit system. In the latter of the above two referred to pending patent applications I have described a method for the reception of radio signals in which the antenna is connected to a wave conductor, the junction point of antenna and wave conductor is grounded through an impedance and a receiving system is coupled to the extreme open end of the wave conductor. I have pointed out that when the wave conductor is adjusted to a quarter wave length or an odd multiple of quarter wave lengths of the signals to be received, the junction point of the antenna and wave conductor is practically at zero potential for that particular signal and none of the signal energy is by-passed to ground through the impedance which is connected to the junction point of antenna and wave conductor. All of the signal energy is absorbed by the wave conductor which is then transmitted through electrostatic coupling to the receiving system. In this invention advantage is taken of this principle to provide means for the elimination of interferences of stations of particular frequencies. The improvements contemplated in this invention will appear evident from the description and discussion of the accompanying drawing which shows typical embodiments of this invention.

In the drawing:

Fig. 1 is a diagrammatic view of the embodiment of the invention in which one wave conductor is associated in the proper manner with the antenna system;

Fig. 2 is a modification showing the use of several wave conductors in association with the antenna system.

Fig. 3 is a modification of Fig. 1 showing a

different method of adjusting the wave conductor.

Having particular reference to the drawing in which the same numbers designate similar parts; in Figure 1 the antenna 1 is connected through coupling coil 2 to ground 3; coupled to coil 2 is a tuned circuit 4 consisting of secondary coupling coil 5 and variable condenser 6, suitable amplification and detecting means of the usual types are connected to the terminals 7 and 8. At the junction point 9 a wave conductor is connected which consists of a solenoidal coil 10, a metal plate 11 in proximity to the coil, the metal plate being grounded at 3. The operation of the invention is as follows: The wave conductor 10, 11, 3 is suitably adjusted preferably to a quarter wave length or an odd multiple of quarter wave lengths of the interfering signal, the adjustment is effected by varying the distance separation of the coil 10 from the grounded metal plate 11, thereby varying the distributed capacity of the coil. When this adjustment is made the junction point 9, in accordance with the theory discussed in the pending patent applications referred to above, is at zero potential for that particular frequency and therefore no current flows in the coupling coil 2 and hence no effect on the receiving circuit 4. The wave conductor 10, 11, 3 absorbs all the energy of the signals of that particular frequency, rendering the receiving system free from any interference by the signals of that particular frequency. For any other frequency, however, the wave conductor has very little effect, if any, and the receiving system responds in the usual manner. In this arrangement therefore it is possible to absorb completely the energy of an interfering signal of a particular frequency, and that without reducing appreciably the efficiency of the receiving system for signals of other frequencies. This is amply borne out by experience and is in accordance with the mathematical deductions worked out by applicant.

Irrespective of theory, however, in practice it is simply a matter of the choice of a wave conductor of suitable design provided with means for adjusting this wave conductor to respond to the interfering signals and absorbing its energy, thereby realizing a condition of rendering the receiving system free from any disturbances which may otherwise be caused by these interfering signals.

The embodiment of the invention shown in Figure 2 differs from that of Figure 1 in that three separate wave conductors 10, 11; 10′, 11′; 10″, 11″ are connected to the junction point 9. Each of these wave conductors is separately adjusted to a quarter wave length or an odd multiple of quarter wave lengths of a different interfering signal, thereby preventing any of three different interfering signals of different frequencies for which these wave conductors are in adjustment to affect the receiving circuit.

This method may be extended for the elimination of interferences for any number of local transmitting stations by the simple expedient of connecting on at 9 a number of wave conductors each separately adjusted to a frequency of each of the interfering signals. This system is of particular advantage for localities where several broadcasting transmitters are in operation blanketing reception from different stations.

Figure 3 is a modification of Figure 1 showing a different method of adjusting the wave conductor. In this arrangement the wave conductor consists of two coils 12 and 13 connected in series at the ends 15 and 16 by the lead 14. Coil 13 is slidable within coil 12, and by sliding one coil within the other an adjustment is effected.

Other methods of accomplishing the adjustment of the wave conductor may be used than those shown in the foregoing description without departing from the spirit of the invention.

I claim:—

1. In a system for the reception of radio signals comprising an antenna, a coupling coil and ground connection constituting the antenna circuit, a secondary tuned circuit coupled to the said coupling coil, and suitable means for amplification and detection coupled to the said tuned circuit, an adjustable wave conductor connected at the junction point where the antenna is connected to the said coupling coil, said wave conductor being adjustable to absorb the energy of an interfering signal of a particular frequency, the said wave conductor consisting of a solenoidal coil placed in close proximity to a grounded metal plate, the adjustment being effected by varying the distance separation of the said solenoidal coil from the said grounded metal plate.

2. In a system for the reception of radio signals comprising an antenna and a coupling coil and ground connection constituting the antenna circuit, a secondary tuned circuit coupled with the said coupling coil, and suitable means for amplification and detection coupled to the said secondary tuned circuit, an adjustable wave conductor connected at the junction point where the antenna connects with the said coupling coil, the said wave conductor being adjustable to a quarter wave length of the interfering signal which is desired to eliminate from the receiving system.

3. In a system for the reception of radio signals comprising an antenna and a coupling coil and ground connection constituting the antenna circuit, a secondary tuned circuit coupled with the said coupling coil, and suitable means for amplification and detection coupled to the said secondary tuned circuit,

an adjustable wave conductor connected at the junction point where the antenna connects with the said coupling coil, the said wave conductor being adjustable to an odd multiple of quarter wave lengths of the interfering signal which is desired to eliminate from the receiving system.

4. In a system for the reception of radio signals comprising an antenna, a coupling coil and ground connection constituting the antenna circuit, a secondary tuned circuit coupled to the said coupling coil, and suitable means for amplification and detection coupled to the said tuned circuit, a plurality of wave conductors connected at the junction point where the antenna is connected to the said coupling coil, each of the said wave conductors being adjustable to absorb the energy of some particular interfering signal, each of said wave conductors consisting of a solenoidal coil placed in proximity to a grounded metal plate, the adjustment of each wave conductor being separately effected by varying the separation distance of each of said solenoidal coils from each of the grounded metal plates associated therewith.

5. In a system for the reception of radio signals comprising an antenna, a coupling coil and ground connection constituting the antenna circuit, a secondary tuned circuit coupled to the said coupling coil, and suitable means for amplification and detection coupled to the said secondary tuned circuit, a plurality of wave conductors connected at the junction point where the antenna is connected to the said coupling coil, each of said wave conductors being separately adjustable to a quarter wave length of an interfering signal.

6. In a system for the reception of radio signals comprising an antenna, a coupling coil and ground connection constituting the antenna circuit, a secondary tuned circuit coupled to the said coupling coil, and suitable means for amplification and detection coupled to the said secondary tuned circuit, a plurality of wave conductors connected at the junction point where the antenna is connected to the said coupling coil, each of said wave conductors being separately adjustable to an odd multiple of quarter wave lengths of an interfering signal.

7. In a system for the reception of radio signals comprising an antenna, a coupling coil and ground connection constituting the antenna circuit, a secondary tuned circuit coupled to the said coupling coil, and suitable means for amplification and detection coupled to the said secondary tuned circuit, a plurality of wave conductors connected at the junction point where the antenna is connected to the said coupling coil, each of said wave conductors being separately adjustable to an odd multiple of quarter wave lengths of an interfering signal, each of said wave conductors comprising a solenoidal coil placed in close proximity to a grounded metal plate, the adjustment of each of said wave conductors being effected by varying the separation distance of said solenoidal coil from the said metal plate.

In testimony whereof I affix my signature.

LOUIS COHEN.