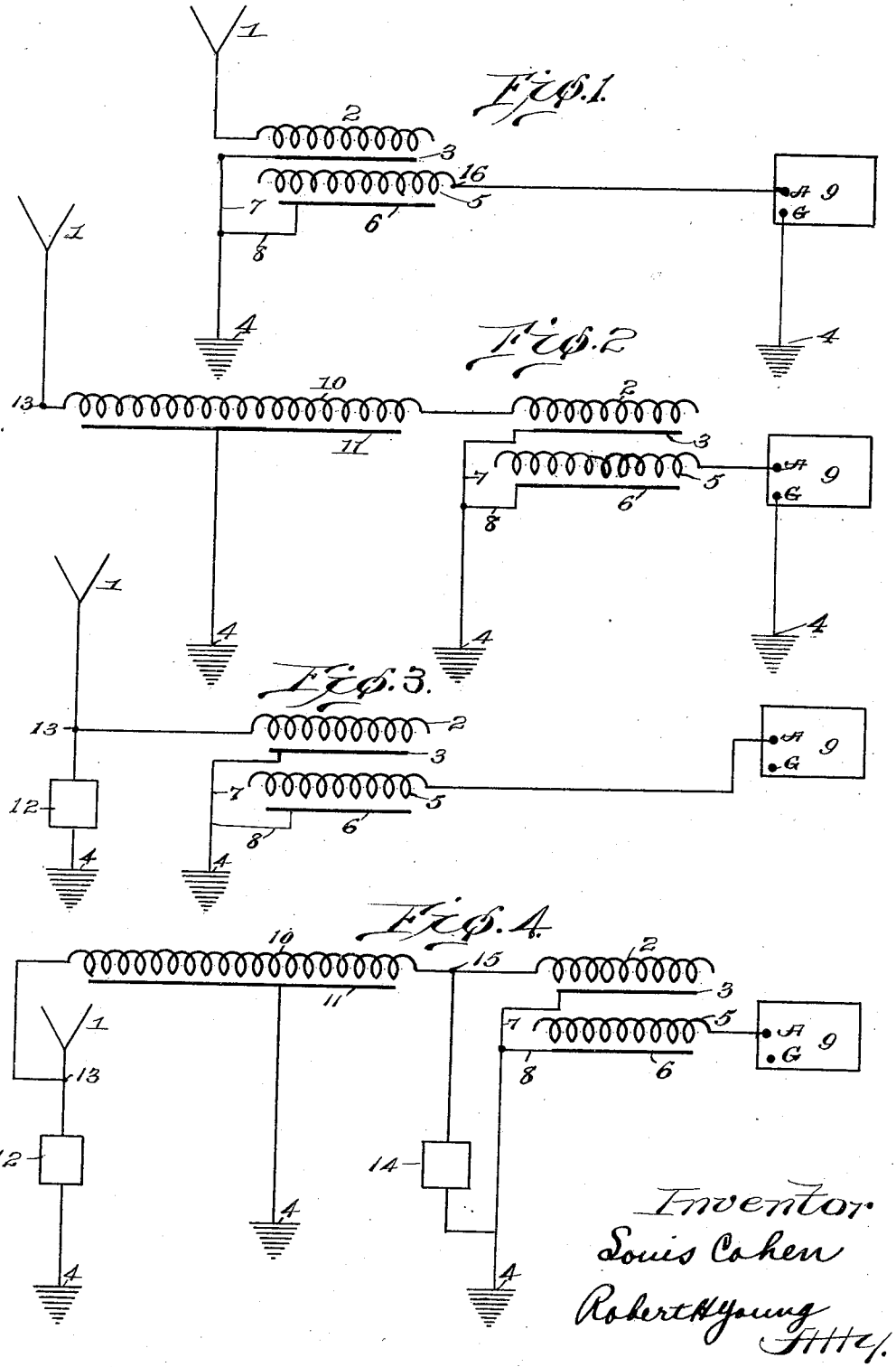
April 19, 1932. L. COHEN 1,854,448

RADIOSIGNALING

Filed Sept. 17, 1928 2 Sheets-Sheet 1



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Filed Sept. 17, 1928 2 Sheets-Sheet 2

Fig. 5.

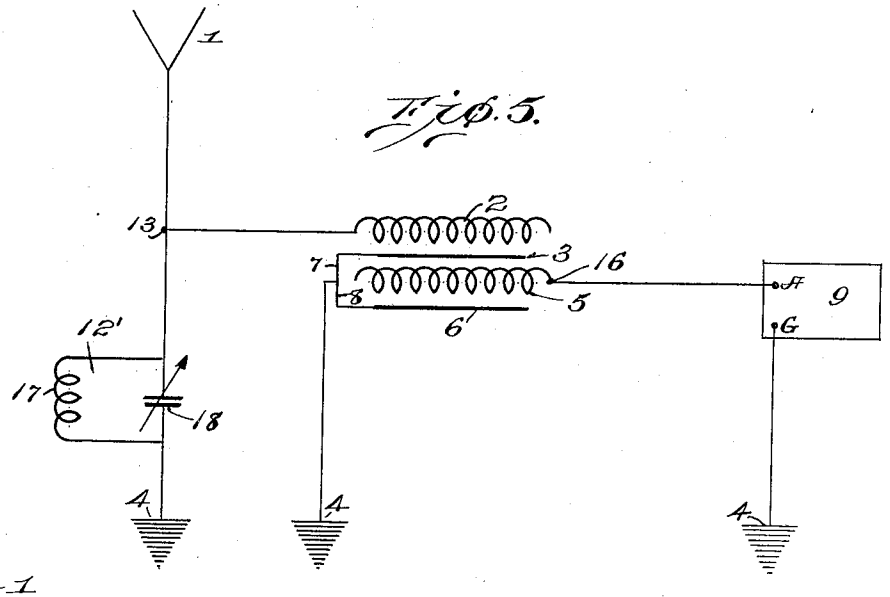
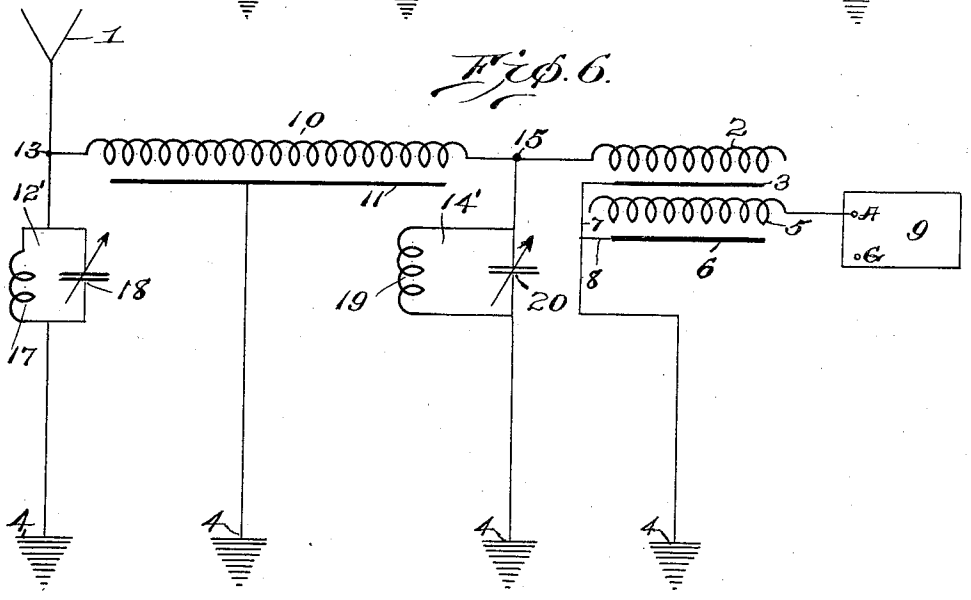


Fig. 6.



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UNITED STATES PATENT OFFICE

LOUIS COHEN, OF WASHINGTON, DISTRICT OF COLUMBIA

RADIO SIGNALING

Application filed September 17, 1928. Serial No. 306,577.

(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.

The invention has for its object an improvement in methods and means for the reception of radio signals by which a high degree of selectivity and freedom from interfering disturbances are secured.

This invention is an extension of the inventions covered by my patent applications relating to radio signaling, serially numbered 293,608; 294,742; 299,386 and 303,087 and filed July 18, July 23, August 13, and August 30, 1928 respectively. The same principles are utilized in this invention but in a modified form securing thereby additional improvements in the selective reception of radio signals.

Particular reference may be had to my copending patent application, Ser. Number 293,608 filed July 18, 1928, in which a method for the reception of radio signals is disclosed which consists in interposing a wave conductor between the antenna and the receiving circuit system, the wave conductor being one of distributed inductance and capacity and adjustable in relation to the frequency of the signals desired to receive. It is shown that by placing a receiving circuit system in inductive relation to the wave conductor and suitably adjusting both the receiving circuit system and the wave conductor, a high degree of selectivity in the reception of radio signals is obtained.

In this invention a modification is introduced which consists in the use of two wave conductors placed in inductive relation to each other; one of the wave conductors is connected to the antenna and the other wave conductor is connected to the receiving circuit system. By the suitable adjustment of the two wave conductors and the degree of coupling between them a still further improvement is obtained in the matter of selective reception of radio signals.

The improvements contemplated in this invention will appear evident from the description and discussion of the accompanying drawings which show typical embodiments of the invention.

In the drawings:

Fig. 1 is a diagrammatic view of the embodiment of the invention showing two coupled wave conductors, one connected to the antenna and the other to a receiving circuit system.

Fig. 2 is a modification in which three wave conductors are used, the antenna connecting to two wave conductors in series and the receiving circuit coupled through a wave conductor to the second of the two antenna wave conductors.

Fig. 3 is a modification of Figure 1 in that the antenna is grounded through an impedance;

Figure 4 shows a modification in which the antenna is grounded through an impedance and also a nodal point of the antenna wave conductor grounded through an impedance.

Figure 5 is similar to Fig. 3, showing however, a tuned circuit as the grounded impedance of the antenna;

Figure 6 is a modification of Fig. 4 showing tuned circuits in place of the two grounded impedances of Fig. 4.

Having particular reference to the drawings in which the same numbers designate similar parts in all of the drawings in Figure 1 the antenna designated by 1 is connected to coil 2 which is placed in proximity to metal plate 3 which is grounded at 4 through lead 7. The coil 2 together with the grounded metal plate 3 forming a wave conductor, that is a conductor of distributed inductance and capacity on which a wave development may be effected by an incoming signal acting on the antenna. The distributed capacity of the wave conductor is varied by varying the distance separation of the coil from the metal plate which may be accomplished in various ways. The wave conductor 5, 6, 4 which is of exactly the same form as the wave conductor 2, 3, 4, is placed in inductive relation to the latter. It is preferable to parallel the two wave conductors and adjust the separation between them until the best results are

obtained. The receiving circuit system 9 is connected to terminal 16 of wave conductor 5, 6, 4. In the practical operation of this circuit system an adjustment is effected by varying the separation distances of coils 2 and 5 from their respective grounded metal plates 3 and 6. The adjustment of wave conductor 2, 3, 4 is somewhat more critical but in any case the point of best adjustment is evidenced by the intensity of the signals in the receiver 9. Theory would indicate that the adjustments of the wave conductors should be for a quarter wave length of the signals desired to receive. I shall accordingly designate the system shown in Figure 1 as a quarter wave length system.

It is preferable to have in this arrangement the two wave conductors of the same design but it is not essential. The coils of the two wave conductors may be of different dimensions and different number of turns of wire on each, provided that they are so designed that each can be adjusted for the particular range of signal frequencies for which their use is intended. The letters A and G on the receiver box 9 indicate the antenna and ground connections respectively of the receiver. In the arrangements disclosed in this invention the receiver may or may not be grounded, that is the ground connection G may or may not be connected to ground 4.

The modification shown in Figure 2 consists in interposing an additional wave conductor 10, 11, 4 in the antenna circuit. This wave conductor is adjustable to approximately double the electrical wave length of wave conductors 2, 3, 4 so that together it forms a three quarter wave length conductor. The wave conductor 5, 6, 4 is placed in inductive relation to wave conductor 2, 3, 4 as in the arrangement shown in Figure 1. This offers a somewhat additional improvement in the matter of selectivity.

The arrangement shown in Figure 3 differs from Figure 1 only in that the antenna is grounded at 4 through a variable impedance 12; that is at the junction point 13 where the antenna connects to the wave conductor 2, 3, 4 a grounded connection is made through a variable impedance. This impedance 12 may be in the form of a variable resistance, variable inductance, variable condenser or a combination of these elements. In the pending applications referred to above the theory of the circuit was discussed and it was pointed out that when the wave conductor 2, 3, 4 is properly adjusted to approximately a quarter or an odd multiple of quarter wave lengths then for a signal of that wave length for which it is in adjustment, the junction point 13 is at a minimum potential, practically zero potential, if the resistance of the wave conductor is small and hence grounding that point through an impedance has very little, if any, effect in impairing the efficiency of reception of signals of that particular frequency. For signals, however, of other frequencies the junction point 13 is no longer at zero value and hence a considerable amount of the signal energy will leak away to ground at that point. This therefore offers an additional means for increasing the selectivity of reception. This is of particular advantage in the elimination of irregular disturbances such as static or other interferences.

The modification shown in Figure 4 is an extension of the arrangement of Figure 2 in that a three quarter wave length conductor is used in the antenna circuit, and impedance leaks are connected to ground at the two nodal points 13 and 15 which contribute much to the increase in the selectivity of signal reception; all of which is in accordance with the theory given in my pending applications referred to and which is amply supported and corroborated by experimental tests.

The circuit system of Fig. 5 differs from that of Figure 3 in that the impedance 12′, through which the antenna is grounded is in the form of a tuned loop circuit which consists of an inductance 17 in parallel with the variable condenser 18. By suitably tuning this circuit, a still further increase in the selectivity of the system is obtained.

The modification shown in Figure 6 differs from that of Figure 4 in that the impedances 12 and 14 of that figure are replaced by tuned circiuts 12′ and 14′, each consisting of an inductance and a variable condenser in parallel; that is the antenna is grounded at 13 through the tuned circuit 12′ which consists of inductance 17 and a variable condenser 18. Also the nodal point 15 is grounded through the tuned circuit 14′ which consists of an inductance 19 and a variable condenser 20. By properly tuning the circuits 12′ and 14′ and suitably adjusting the wave conductors a remarkably high degree of selectivity in the reception of radio signals is obtained.

I claim:

1. In a system for the reception of radio signals, comprising an antenna, and two adjustable wave conductors in inductive relation to each other, one of said wave conductors being connected to said antenna, and the other of said wave conductors being connected to a receiving circuit system provided with means for detection and amplification, and means for adjusting each of said wave conductors to a quarter wave length of the signals desired to be received.

2. In a system for the reception of radio signals, comprising an antenna, and two adjustable wave conductors in inductive relation to each other, one of said wave conductors being connected to said antenna, and the other of said wave conductors being connected to a receiving circuit system provided with means for detection and amplification, means

for adjusting said wave conductor which is connected to said antenna to an odd multiple of quarter wave lengths and means for adjusting said other wave conductor to a quarter wave length of the signal desired to be received.

3. In a system for the reception of radio signals comprising an antenna, two adjustable wave conductors in inductive relation to each other, one of said wave conductors being connected to said antenna and means for adjusting the same to approximately three quarter wave lengths of the desired signal, grounded impedance leaks connected at the junction point of connection of said wave conductor to said antenna and at the nodal point on said wave conductor, which is approximately half wave length distance from said junction point, the other of said wave conductors being connected to a receiving circuit system provided with means for detection and amplification.

4. In a system for the reception of radio signals comprising an antenna, two adjustable wave conductors in inductive relation to each other, one of said wave conductors being connected to said antenna and means for adjusting the same to approximately three quarter wave lengths of the desired signal, grounded impedance leaks connected at the junction point of connection of said wave conductor to said antenna and at the other nodal point of said wave conductor, the other of said wave conductors being connected to a receiving circuit system provided with means for detection and amplification, each of said impedances being in the form of a tuned loop circuit comprising an inductance and capacity in parallel.

5. In a system for the reception of radio signals comprising an antenna, two adjustable wave conductors in inductive relation to each other, one of said wave conductors being connected to said antenna and means for adjusting the same to approximately three quarter wave lengths of the desired signal, grounded impedance leaks connected at the junction point of connection of said wave conductor to said antenna and at the other nodal point of said wave conductor, the other of said wave conductors being connected to a receiving circuit system provided with means for detection and amplification, each of said impedances being in the form of a tuned loop circuit comprising an inductance and capacity in parallel, said tuned loop circuits being tuned for the frequency of the desired signals.

6. In a system for the reception of radio signals, comprising an antenna, and two adjustable wave conductors in inductive relation to each other, one of said wave conductors being connected to said antenna, and the other of said wave conductors being connected to a receiving circuit system provided with means for detection and amplification, said antenna being grounded through a tuned loop circuit comprising an inductance and capacity in parallel, and means for tuning said loop circuit for the frequency of the desired signals.

In testimony whereof I affix my signature.

LOUIS COHEN.