

April 9, 1935.

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1,997,271

LOOP RECEIVER

Filed Oct. 24, 1933

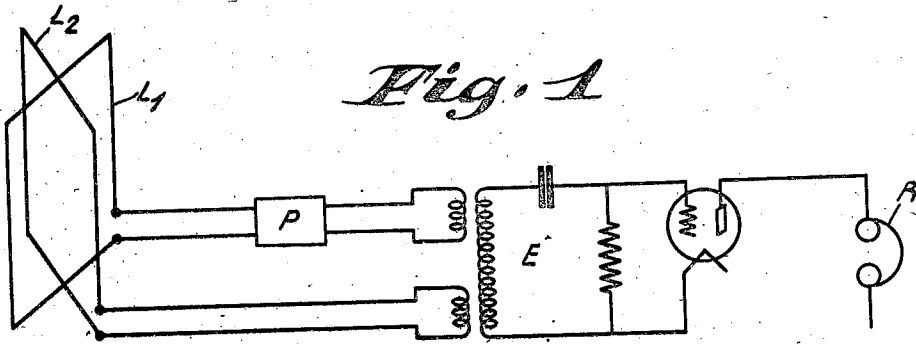


Fig. 1

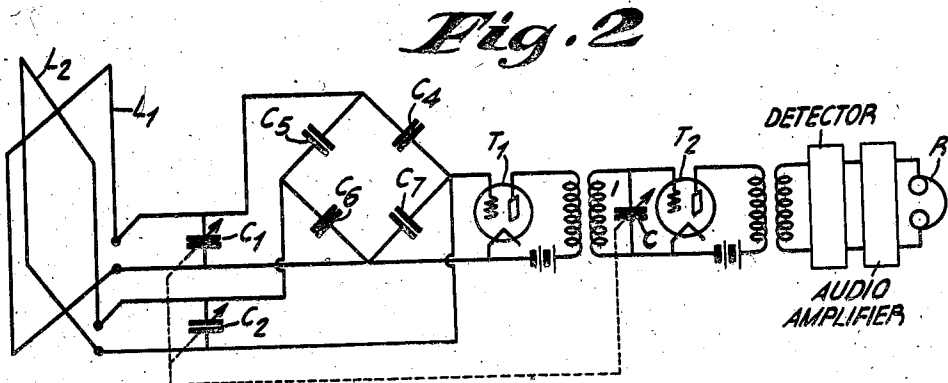


Fig. 2

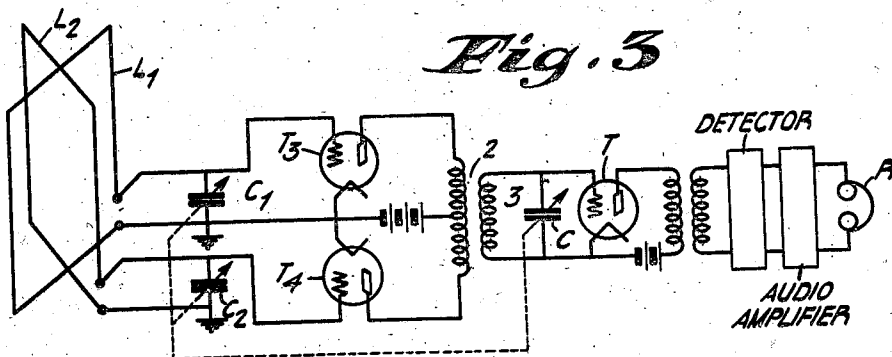


Fig. 3

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1,997,271

LOOP RECEIVER

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Application October 24, 1933, Serial No. 694,937
In Germany January 22, 1932

2 Claims. (Cl. 250—20)

The present invention relates to loop receiver arrangements adapted for use in the reception of broadcast signals and the like. The invention is particularly concerned with an arrangement of coils or loops for receiving signals emanating from every direction with substantially equal efficiency irrespective of the position of the loops with respect to space.

A particular object of the invention is to devise an efficient system adapted for receiving signals on moving vehicles whereby the reception efficiency is not affected by the direction of motion of the vehicle.

Loop antennae have the property of receiving substantially only signals emanating from transmitting stations whose magnetic vector is orientated at right angles to the loop antenna, a property extensively utilized in direction finders. However, in some instances loop antenna arrangements are desired which preferably have no specific selective characteristics as is the case in automobile type receivers. In these instances horizontally mounted receiver loops are desirable for general broadcast reception. Such horizontally disposed receiving antennae insure no particularly favorable reception especially in view of the circumstance that most long wave transmitter equipments send out waves whose magnetic vector is positioned horizontally.

By using vertically orientated receiving loops the directional effects are obtained to a considerable extent so that it has been found desirable to utilize two crossed loops having separate circuits and combining the energy from the two loops in any suitable reproducing system. In this way fairly good reception is obtained from all directions. However, it is a fact that even in such systems utilizing the crossed loops there exist the drawback that where the signal is equal in both loops the energy from both the loops would be bucked out unless special precautions be taken with the result that signals would not be received from certain directions.

The present invention contemplates the use of two vertically orientated receiving loops or coils for reception of signalling energy whose planes are disposed at right angles to each other. Broadly speaking in the present invention, the oscillations picked up by the two receiving loops are fed by way of phase shifting means insuring a lagging of the currents by an angle of 90 degrees to a joint or common utilizing circuit. It can readily be shown that such an arrangement does not exhibit any pronounced selective or direc-

tional receiving characteristics in the horizontal plane.

More specifically, the present invention utilizes a pair of crossed loops arranged preferably at right angles to each other and means for changing the phase of desired signals preferably 45 degrees in each loop so that the signals in the common circuit are 90 degrees out of phase with each other. This, of course, prevents any bucking out action of desired signals since it is a well known fact that for energy to be completely bucked out the phase difference must be 180 degrees at the point where the bucking action takes place. The desired phase which is, in accordance with the invention, obtained by slightly detuning each of the loops as will be hereinafter more fully described.

In the drawing, Figure 1 represents generally a circuit diagram utilized to explain the principle of the invention;

Figure 2 represents diagrammatically a more complete form of the invention utilizing crossed loops in connection with a bridge circuit; and,

Figure 3 illustrates a preferred embodiment of the invention wherein the crossed loops feed into a double electronic tube circuit.

In Figure 1, L_1 and L_2 are the crossed receiver loops. As is obvious from said figure the oscillations picked up by said loops are fed by way of phase shifting means P connected in the leads from the loop L_1 to a joint input circuit E . The system in Figure 1 shows only a single phase shifter for performing the desired functions. It may be desired, however, to utilize two phase shifting devices so that the phase shift in each system will not have to be large. The input circuit E is the usual input circuit connected with a thermionic tube, the output of which includes any suitable reproducing device R . From Figure 1 it will be seen that the difference in phase of the signalling energy in the two branches prevents any possible bucking out action in the common circuit E .

In Fig. 2 the two crossed loops L_1 and L_2 are provided with a tuning condenser C_1 and C_2 respectively. The loop L_1 is connected to two opposite points of a bridge made up of condensers C_4 , C_5 , C_6 and C_7 , while the loop L_2 is connected to opposite points of said bridge as shown. One arm of the bridge, including the condenser C_7 , forms the input circuit of an amplifier tube T_1 , the output of which is connected to the tuned input I of a second tube T_2 . The tuned input circuit I includes a tuning condenser C which is arranged for uni-control together with the tuning

condensers C_1 , C_2 . The output of the tube T_2 may be coupled to a suitable detector circuit and the energy from the detector circuit amplified by suitable audio amplifying means and fed to any desirable reproducing device shown for purposes of illustration as R. In the operation of the system shown in Figure 2 the two loops are slightly detuned; one above the desired frequency and the other below the desired frequency by the tuning condensers C_1 and C_2 . Both loops feed into the single tube T_1 through the bridge arrangement which arrangement prevents the tuning of one of the loops from effecting the tuning of the other loop in well known manner.

In Figure 3, loop L_1 and its associated tuning condenser C_1 , feeds into the input of a tube T_3 while the tube L_2 with its associated tuning condenser C_2 is arranged to form part of the input circuit of the tube T_4 . The outputs of tubes T_3 and T_4 are arranged push-pull fashion and include the split transformer 2 coupled to the input 3 of amplifier tube T. The input 3 includes a tuning condenser C which is arranged for uni-control together with the condensers C_1 and C_2 .

The output of the tube 2 is arranged to be coupled in any suitable fashion to a detector circuit and the output of the detector circuit may be passed through a suitable amplifier arrangement and reproducer device.

In operation of the system shown in Figure 3, circuit 3 is tuned to the desired carrier by means of the condenser C. Loop L_1 is tuned slightly below the desired carrier by means of condenser C_1 and loop L_2 is tuned slightly above the carrier by means of the tuning condenser C_2 . The tuning of the loops L_1 and L_2 is arranged so that the phase difference of the voltage applied to the grids of tubes T_1 and T_2 is approximately 90 degrees thereby preventing any bucking out action in the output of the tubes T_3 and T_4 . It should be particularly noted that in the system shown in Figure 3 interfering frequencies produce similar phase inputs to the grids of tubes T_3 and T_4 so that the interference tends to cancel out in the differential transformer 2, especially

when the magnitude of the interference picked up by the two loops L_1 and L_2 are nearly equal.

It is to be understood that other embodiments of the invention fall clearly within the scope of the present invention and that the scope of the invention is to be limited only by the claims:—

I claim:

1. In a receiving system a pair of crossed loops, individual means for tuning each loop, a bridge circuit, means for coupling said loops to opposite points of said bridge, a utilizing circuit and means for coupling the input thereof across one arm of the bridge said loops being adapted to be tuned one above and the other below the desired carrier frequency said bridge circuit being arranged so as to prevent coupling between the two loops.

2. In a receiving system, a pair of tuned loop antennae each thereof being provided with variable tuning means, a four arm bridge circuit, means for connecting one of said tuned antennae across opposite points of the bridge, means for connecting the other of said tuned antennae across the other two opposite points of the bridge, said bridge circuit being arranged so as to prevent coupling between the two loop antennae, said two antennae being arranged substantially at right angles to each other, a space discharge device provided with input and output circuits said input circuit including one of the arms of said bridge circuit, a second space discharge device provided with a tuned input circuit and an output circuit, said tuned input circuit being provided with a variable tuning element and uni-control means for varying said last named tuning element and the tuning means of said loop antennae simultaneously, said tuning devices being arranged so that the tunable input circuit is tuned to substantially the desired carrier frequency whereas one of the loop antennae is tuned slightly above the desired carrier frequency while the other of said loop antennae is arranged to be tuned slightly below the desired carrier frequency and a utilizing circuit coupled to the last named output circuit.

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