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W. L. CARLSON ET AL

2,233,283

NOISE REDUCING SYSTEM

Filed Jan. 31, 1939

FIG. 1.

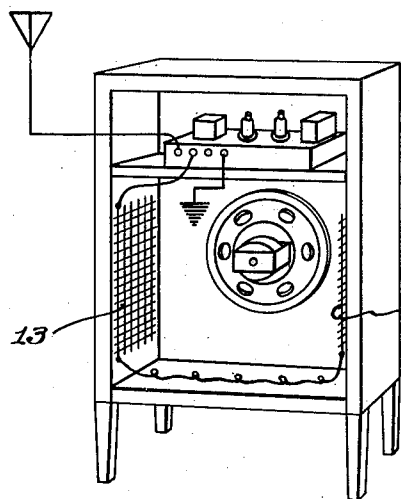


FIG. 3.

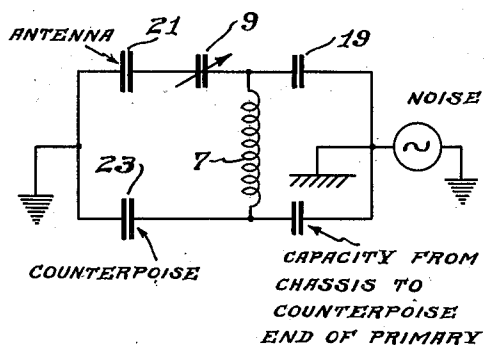


FIG. 2.

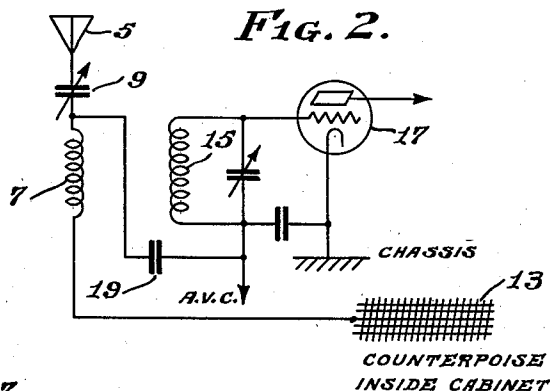
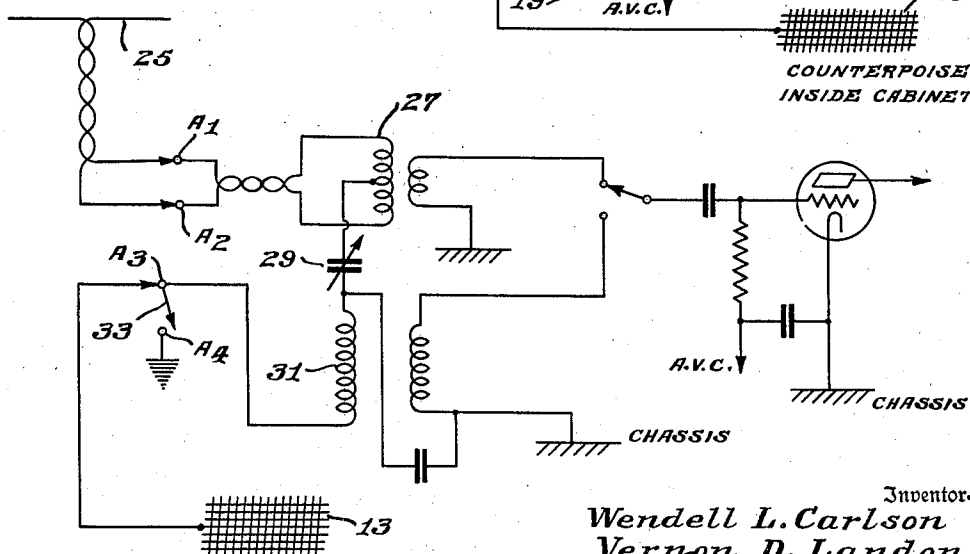


FIG. 4.



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NOISE REDUCING SYSTEM

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8 Claims. (Cl. 250—20)

This invention relates to noise-reducing systems which are useful in eliminating the undesired noises which are produced in radio receivers by locally generated electrical impulses, and which are frequently transferred to a receiver from adjacent power lines, motors, and the like.

The present invention is related to that shown in a copending application of V. D. Landon, Serial No. 210,323, filed May 27, 1938, and entitled "Noise reduction systems."

Many systems have been proposed for improving radio reception by the reduction of local noise impulses. Most of the systems known require complicated antennas and input transformers and elaborate shielding. For example, a dipole antenna having a twisted pair downlead conductor will prevent the transfer of noise currents which are induced in both conductors of the downlead when properly connected to a balanced input transformer. Other known systems require two separate antennas, but in each case noise reduction is accomplished by means of a comparatively complicated antenna arrangement.

It is the principal object of this invention to provide a receiver which is capable of reducing the interfering local noise impulses when operated in conjunction with an ordinary single wire antenna. As far as we are aware, we are the first to propose a noise-reducing antenna system which operates successfully using only an ordinary single wire antenna and no external accessories.

In accordance with this invention, a counterpoise is incorporated in the receiver cabinet which, in conjunction with a simple receiver input circuit and a single wire antenna, functions to give noise reduction.

A further object of this invention is to make use of the built-in counterpoise by providing means for connecting it as an antenna where reception without noise reduction is possible.

This invention will be better understood from the following description when considered in connection with the accompanying drawing, in which Figure 1 illustrates an embodiment of this invention; Figure 2 is a circuit diagram of a simple form of noise-reducing system; Figure 3 is an equivalent circuit for explaining the operation of this invention; and Figure 4 is a modified form for use with a dipole antenna and a two-band receiver.

It was pointed out in the above-identified copending Landon application that much of the noise encountered in radio reception is due to

undesired electrical impulses which come into the receiver over the power supply line and produce a noise voltage between the receiver chassis and ground. Noise may also be present in the vicinity of a radio receiver due to radiation from nearby motors and other similar devices. The problem of reducing the effect of such noises on a radio receiver was solved in accordance with the above-identified copending application by providing a long and a short antenna, the pickup due to the two antennas being balanced out in the receiver input circuit. The use of two antennas is not necessary, however, in accordance with the present invention. As shown in Fig. 1, a counterpoise which is built into the receiver cabinet is substituted for the short antenna. The customer thus obtains automatic noise compensation when the receiver is connected to an ordinary single wire antenna. As will appear subsequently, a ground connection may be used if desired.

A simplified input circuit which is suitable for use with the noise-reducing system of this invention is shown in Fig. 2, to which reference is now made. An antenna 5 is connected to one terminal of a primary winding 7 through a variable capacitor 9. The other terminal of the primary is connected to a counterpoise 13, which is built into the receiver cabinet as shown in Fig. 1. The usual secondary winding 15 is shown coupled to the primary 7 and connected to the input of an amplifier or mixer tube 17. A small capacitor 19 is connected between the receiver chassis and the antenna terminal of primary 7.

Fig. 3 is an equivalent circuit of the arrangement shown in Fig. 2. The antenna to ground capacity is represented by capacitor 21. The effective antenna to ground capacity is made variable by connecting it in series with variable capacitor 9. The capacity existing between the counterpoise 13 and ground is represented by capacitor 23. Since the counterpoise terminal of the primary 7 is not connected directly to the chassis a certain capacity to the chassis exists due to its physical relation to the chassis and due, in part, to the capacity of the adjacent secondary winding 15. The capacity from the antenna terminal of the primary 7 to chassis is usually less than that from the counterpoise terminal, and therefore a small capacitor 19 is employed to make the two capacitances approximately equal.

A consideration of the circuit shown in Fig. 3 indicates that, when the various capacitors are properly adjusted, a balanced bridge circuit is

obtained and the noise voltage will not appear across the terminals of the primary winding 7, and therefore will not be present in the receiver. This balanced condition is achieved by varying one of the capacitors, for example capacitor 9. When such a condition has been achieved, local noise impulses which are present are induced in like amplitude on the lead-in from the antenna 5 and the counterpoise 13. The induced noise voltages are thus impressed in opposite phase across the terminals of the primary 7, so that no noise current flows through the primary 7.

A modified form of our invention is shown in Fig. 4. In accordance with this embodiment of our invention, a dipole antenna 25 may be utilized for high frequency reception. The input circuit to the receiver consists of a high frequency balanced primary winding 27 having a center tap connection which is connected through a variable capacitor 29 to one terminal of a low frequency primary winding 31. The terminals of the balanced primary 27 are connected to a pair of input terminals A₁ and A₂. The remaining terminal of the low frequency primary 31 is connected to an input terminal A₃. A fourth input terminal A₄ is connected to ground. A short-circuiting link 33 is provided to connect terminals A₃ and A₄ when desired. The counterpoise 13 is adapted to be connected to any one of the input terminals, although it is shown connected to A₃.

In the arrangement shown, noise reduction is obtained at high frequencies by reason of the balanced input system and the twisted pair lead-in from the dipole antenna 25. At low frequencies, the dipole 25 and the associated lead-in functions as a capacity antenna and provides signal for the low frequency primary 31. Noise reduction at low frequencies is accomplished in the manner described above by means of the counterpoise 13.

In certain instances, it may be desirable to operate a receiver without any antenna. While noise reduction cannot be obtained without an antenna, the system shown in this application provides a simple arrangement for receiving in localities which are free from local interferences. By connecting the counterpoise 13 to either one of the terminals A₁ or A₂, and by connecting A₃ to ground, satisfactory reception may be had.

We claim as our invention:

1. A radio apparatus including a receiver chassis and a cabinet for said chassis, said chassis including an antenna input circuit, a counterpoise within said cabinet, means for connecting said counterpoise to one terminal of said input circuit, means for connecting an antenna to the other terminal of said input circuit, and means for adjusting the amplitudes, relative to said chassis, of signals picked up in the vicinity of said receiver by said counterpoise and said antenna.

2. In a radio apparatus, the combination of a cabinet and a receiver having low frequency and high frequency input transformer primary windings, said high frequency winding having a center tap terminal connected to one terminal of said low frequency primary, and two outer terminals

for connection to an antenna, a counterpoise mounted within said cabinet and connected to the other terminal of said low frequency primary to minimize the reception of noise-producing currents.

3. A radio receiving system which includes a radio cabinet, a radio receiver in said cabinet, a counterpoise mounted in said cabinet for connection to said receiver to provide signal pickup in the absence of an antenna and means for utilizing said counterpoise to reduce noise pickup when said receiver is operated in conjunction with an antenna.

4. In a radio apparatus including a cabinet and a radio receiver the chassis of which is at ground potential, an input winding provided with a pair of ungrounded terminals for connection, respectively, to an antenna and a counterpoise, and means for equalizing the capacity of said antenna and said counterpoise to said chassis.

5. A noise reducing radio system which includes a radio cabinet and a radio receiver in said cabinet, a counterpoise mounted in said cabinet, said receiver having an input circuit, means for connecting said counterpoise to one terminal of said input circuit and for connecting the other terminal of said input circuit to an antenna to produce reception with reduced noise interference, and means for connecting said counterpoise to said other terminal of said input circuit to provide signal pickup for reception in the absence of said antenna.

6. A radio receiving system which includes a radio cabinet, a radio receiver having an input circuit, a counterpoise mounted in said cabinet, said input circuit having a pair of terminals, means for connecting said counterpoise to a desired one of said terminals and an antenna to the other of said terminals to balance out noise induced in said antenna, and means for grounding one of said terminals and connecting said counterpoise to the other of said terminals to provide reception in the absence of said antenna.

7. A radio receiver chassis having low frequency and high frequency input circuits, said high frequency circuit including a first inductor for connection to an antenna and having a tap intermediate its ends, and said low frequency circuit including a second inductor, means coupling said tap to one terminal of said second inductor, a counterpoise connected to the other terminal of said second inductor, and means for equalizing the capacity of said antenna and said counterpoise, respectively, to said chassis.

8. A radio receiver chassis having low frequency and high frequency input circuits, said high frequency circuit including a first inductor for connection to an antenna and having a tap intermediate its ends, and said low frequency circuit including a second inductor, a variable capacitor coupling said tap to one terminal of said second inductor, a counterpoise connected to the other terminals of said second inductor, and a capacitor connected between said one terminal of said second inductor and said chassis.

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