May 21, 1940. E. FRANKE 2,201,337

CIRCUIT ARRANGEMENT FOR REDUCING INTERFERENCE

Filed March 17, 1938

Fig.1

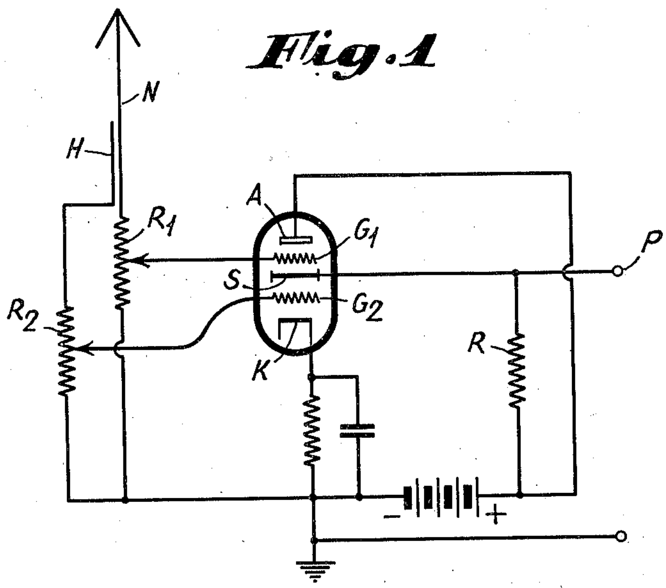
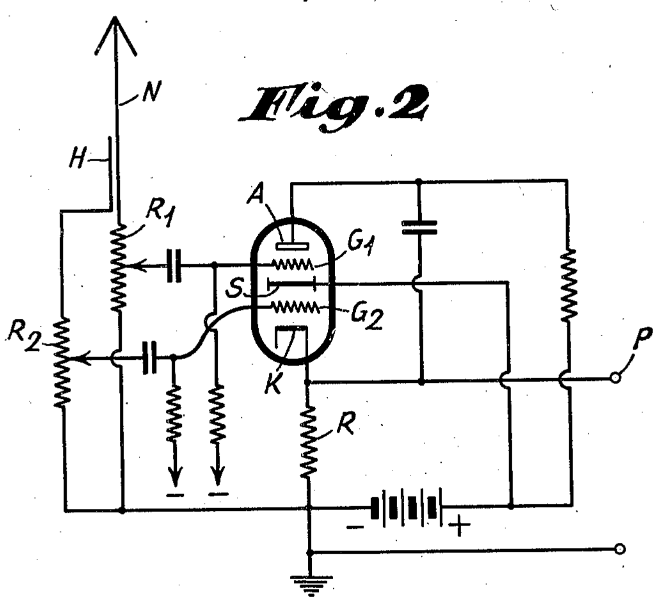


Fig.2



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CIRCUIT ARRANGEMENT FOR REDUCING INTERFERENCE

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4 Claims. (Cl. 250—20)

It is known in the art that with a view to eliminating stray or atmospherics the stray or interfering component superposed upon a signal wave may be compensated by a second alternating potential which preferably contains the stray oscillation. For instance, it is known in the art to compensate neighborhood interference picked up by an unshielded antenna lead by the aid of the potentials picked up by another lead (auxiliary antenna) mounted parallel to the antenna lead and not connected with the antenna. As carried into practice in a certain scheme, compensation could be effected, for example, in such a manner that the two potentials are connected to the ends of the primary winding grounded in the midpoint of a transformer while the secondary potential of the latter is impressed upon a standard RF amplifier. Since the stray or interfering potentials picked up by the auxiliary antenna are in phase with those picked up by the downlead of the main antenna, while the latter has an excess of signal energy, it follows that the amplitudes of the potentials fed to the transformer may be so balanced that only the useful or signal potential will arise at the secondary end.

One drawback inherent in this arrangement is that exact neutralization of the stray component is possible only for one frequency because of inevitable lack of symmetry of the transformer, and because of various capacitances inhering in the antenna and the auxiliary antenna, so that, in case of change of wave-length, re-adjustment of the amplitude of the compensation potential is required.

Now, with a view to insuring compensation which is not a function of the frequency it has already been suggested in the earlier art to impress the two potentials directly, i. e. under aperiodic condition, upon the control grid and the cathode of an electron tube, the latter comprising an ohmic cathode resistance which contrary to usual practice, is not shunted or bridged for RF. Inasmuch as the potentials being in phase in respect to ground control the grid in phase opposition in reference to the cathode, it is possible to so adjust the amplitudes of the two potentials that the stray component in the plate current will be caused to vanish, while the signal or useful potential may be taken off across the plate resistance of the tube. However, this circuit organization contains certain drawbacks which are obviated in the present invention.

According to the invention, the signal potential with the stray potentials superposed thereon, and the compensation or neutralizing alternating potential are separately impressed on distinct electrodes of a multi-electrode tube designed to control the current issuing from the cathode, the said electrodes controlling in push-pull relation the current flowing to a third electrode in the presence of co-phase voltage variation. The fall of alternating potential which is occasioned by the current of the said third electrode across a load resistance, is used as the signal voltage.

What is particularly to be used for the control electrodes are two control grids comprised in a multi-electrode tube between which a third grid is interposed which has a positive biasing potential, and whose current intake in the presence of co-phase voltage variation, will therefore be in phase opposition at the two control grids.

Just like the circuit organization hereinbefore discussed, the present invention offers the advantage that compensation or neutralization is made independent of the frequency. However, over and above this there is the advantage that no limitations at all are imposed so far as the choice of the potential of the cathode is concerned. For instance, the cathode could be grounded for A. C., in other words, directly heated electron tubes could be employed. However, whenever cross modulation is to be cut down to a minimum, a very marked anti-regeneration (reverse generation or feedback) could be produced by connecting the entire load resistance in the cathode lead and by tapping the signal voltage across the same. This scheme would be impracticable in the circuit arrangement hereinbefore mentioned and suggested in the prior art for the reason that in that case there acts across the cathode resistance the compensation potential picked up by the auxiliary antenna and including the strays.

An exemplified embodiment of the invention is illustrated in Fig. 1.

A modification thereof is shown in Fig. 2.

The antenna N of Fig. 1 and the auxiliary antenna H are connected by way of the two voltage dividers R_1, R_2 with the control grids G1, G2 of the tube V. The said voltage dividers are so set that the current of the screen grid S is essentially free from stray components. The plate A, just as the cathode K, could be grounded for RF.

The fall of potential occasioned by the screen-grid current across the outer resistance R of the screen-grid lead may be taken off at point P and be impressed upon the RF amplifier.

In the modified embodiment Fig. 2 the consumer or load resistance R is included in the cathode lead. In this case the cathode should not be grounded capacitively. But the screen-grid is grounded for RF. There is capacitive connection between anode and cathode. As a consequence, there flows through R, as can be seen from Fig. 2, only the grid current which is free from stray or other disturbing components. Hence, R may be used as the load resistance. By the marked reverse coupling which incidentally arises and which may be made variable, if necessary, cross modulation is substantially diminished.

In lieu of an ordinary multi-electrode tube, there could also be used, for instance, a cathode-tube, the two potentials being impressed upon the two opposite deflector plates thereof. Since, for the same voltage variation, one deflector plate will tend to cause shifting of the cathode-ray pencil to the right-hand side, while the other one will tend to occasion deflection to the left, arrangements may be so made that the ray current impacting a suitably formed gathering plate will be subject to push-pull action. In lieu of one, or of both deflector plates, recourse could be had also to concentrator or focusing electrodes. These must then be biased in such a way that, with in-phase voltage variations, one of the concentrator electrodes will focus the pencil, while the other one causes spreading thereof.

What I claim is:

1. A radio receiving system comprising a vacuum tube having a cathode, a plurality of control grids, a screen grid and an anode, a main aerial connected to one of said control grids, an auxiliary aerial connected to another of said control grids, a source of high positive potential and connections therefrom to both the screen grid and anode, a load resistor included in the screen grid to cathode circuit, and output connections across said resistor for leading off the tube output.

2. A radio receiving system comprising a vacuum tube having a cathode, a first control grid, a screen grid, a second control grid and an anode arranged in the order named, a main aerial circuit coupled to one of said control grids, an auxiliary aerial circuit coupled to the other of said control grids, a source of high positive potential and connections therefrom to both the screen grid and anode, and a load resistor included in said connection to the screen grid.

3. A radio receiving system comprising a vacuum tube having a cathode, a first control grid, a screen grid, a second control grid and an anode arranged in the order named, a main aerial circuit coupled to one of said control grids, an auxiliary aerial circuit coupled to the other of said control grids, a source of high positive potential and connections therefrom to both the screen grid and anode, and a load resistor connected between cathode and ground, said resistor being included in the screen grid and anode return circuits.

4. A radio receiving system comprising a vacuum tube having a cathode, a plurality of control grids, a screen grid and an anode, a main aerial circuit including a potentiometer and a variable connection therefrom to one of said control grids, an auxiliary aerial circuit including a potentiometer and a variable connection therefrom to another of said control grids, a source of high positive potential and connections therefrom to both the screen grid and anode, and a load resistor included in the screen grid to cathode circuit.

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