Sept. 30, 1941. E. RAHN 2,257,274

AMPLIFIER CIRCUIT ARRANGEMENT FOR ULTRA-SHORT WAVES

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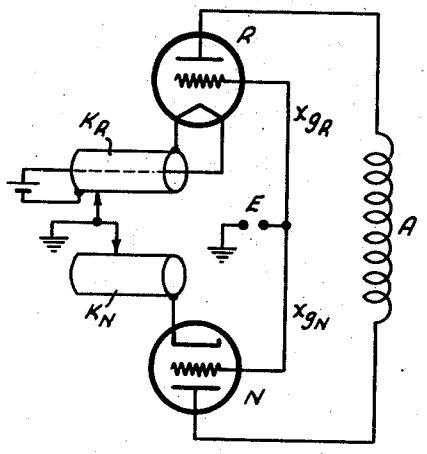


Fig. 1

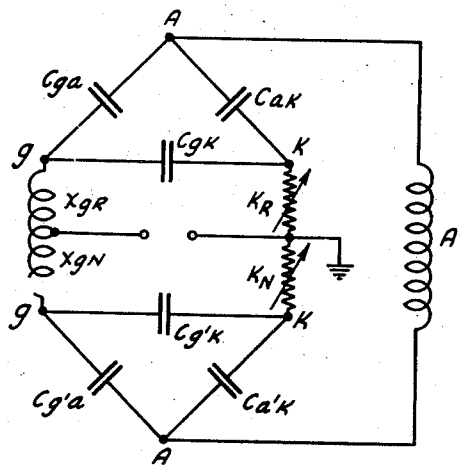


Fig. 2

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## AMPLIFIER CIRCUIT ARRANGEMENT FOR ULTRA-SHORT WAVES

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1 Claim. (Cl. 179—171)

One prerequisite in the amplification of ultra-short waves by means of standard tubes is perfect neutralization. For this purpose recourse is had, as a general rule, to bridge schemes in which the tube together with a tube equivalent being perfectly identical, though unheated, forms a bridge arrangement. One diagonal of the latter contains the input circuit, while the other diagonal contains the output circuit. Now, it has been discovered that where ultra-short waves are dealt with, a setting so that complete neutralization is realized must be extremely accurate, in other words, the agreement between the active tube and the inactive or equivalent tube must be present to a degree that is non-fulfillable in practice. Subsequent variation of the self-capacitances and self-inductances of the tube equivalent or dummy is attended with serious difficulties of a constructional nature, in fact, is no longer feasible with decimeter waves.

According to the invention, in addition to the tube equivalent or inactive tube in a bridge scheme there is provided a tuned cathode circuit. Such tuned cathode circuit in itself is known in the prior art for the purpose of neutralization. One of the two steps, that is, tuned cathode circuit or bridge arrangement, fails to insure a satisfactory neutralization; indeed, it is feasible only by a combination to so offset the drawbacks inherent in either scheme that the circuit organization will be perfectly free from reaction. In order to preserve the balance of the bridge, it is necessary to provide both the active tube as well as its equivalent (the dummy tube) with tunable cathode circuits.

In the accompanying drawing, Fig. 1 illustrates in diagrammatic form an embodiment of the invention using a transmission line for inductance purposes; and, Fig. 2 is a simplified diagrammatic showing of the arrangement shown in Fig. 1 used for purposes of explaining the invention.

Fig. 1 shows the circuit arrangement of the invention. Referring to Fig. 1, R denotes the tube, N its equivalent or the inactive tube; E is the input circuit, and A the output circuit. Between the cathodes of the active and the inactive tube and the ground end of the input circuit are inserted tunable circuits $K_R$ and $K_N$, respectively, preferably in the form of tunable parallel-wire lines or tunable co-axial lines.

Fig. 2 shows the substitute scheme of an arrangement as in Fig. 1. $C_{GK}$, $C_{AK}$ and $C_{GA}$ are the tube capacities, and $C'_{GK}$, $C'_{AK}$, and $C'_{GA}$ the capacitances of the dummy or inactive tube. The other reference letters correspond to Fig. 1. It can be seen at once from an examination of Fig. 2 that imperfect neutralization owing to discrepancies as stated between the active and the inactive tube as well as inevitable inductances of the grid leads $X_{GR}$ and $X_{GN}$ can be compensated by the tuning of the impedances $K_R$ and $K_N$. More specifically, voltage across output circuit A will set up voltages across $X_{GR}$ and $X_{GN}$. If, however, suitable inductances $K_R$ and $K_N$ are provided, equal voltages will be set up across $K_R$ and $K_N$ hence no potential difference is produced across $C_{GK}$. Hence, the cathode circuits serve to establish an exact bridge balance. As to details, the construction and arrangement of the cathode circuits may be chosen at will and is accomplishable in any one of the various ways disclosed in the prior art. The circuit $K_R$ and $K_N$ may be tuned conjointly or separately, the latter scheme being preferable for in that way all lack of symmetry will be compensated.

I claim:

In an amplifier circuit especially adapted for ultra-high frequencies, a first tube having an anode, a cathode and a grid electrode, a second tube having substantially similar characteristics as said first tube, said second tube having an anode, a cathode and a grid electrode, a connection having inherent inductance between said two grid electrodes, a pair of input terminals across which the energy to be amplified is applied, one of said terminals being connected to a point of fixed potential, the other thereof to an intermediate point of said inherent inductance, an output impedance device connected between said two anodes, said inherent inductance causing in the operation of said amplifier a potential to be impressed upon the first grid which fluctuates in response to potential fluctuation across said output impedance, inductance means consisting of a pair of parallel conductors connecting said two cathodes individually to a point of fixed potential, said parallel conductors having individual adjustments of length to provide individual inductance values such that in the operation of said amplifier there is impressed upon the cathode of the first tube a potential which is of substantially the same magnitude as the potential impressed upon said first named grid electrode and which also fluctuates in response to the potential fluctuations across said output impedance.

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