Oct. 22, 1935. B. D. H. TELLEGEN 2,018,331

ANTENNA COUPLING

Filed Aug. 18, 1931

Fig. 1

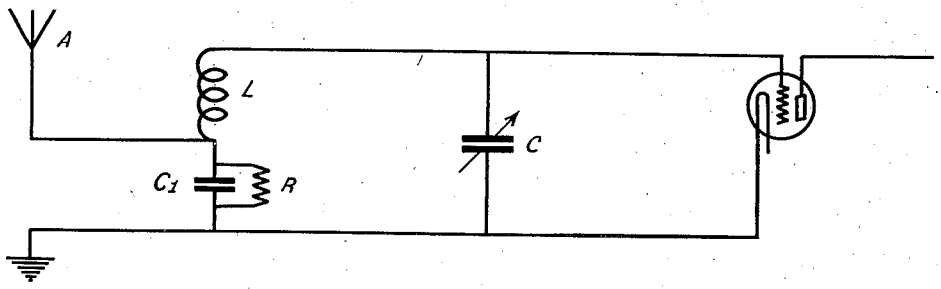


Fig. 2

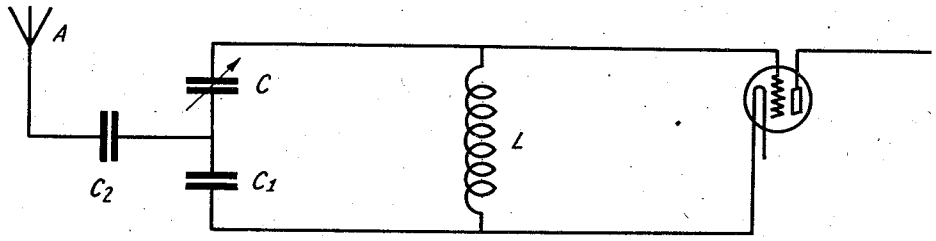
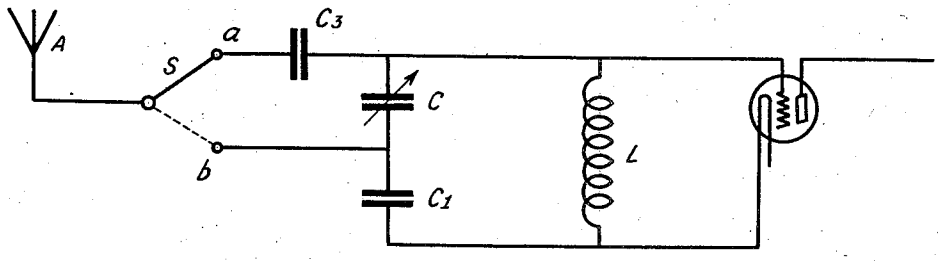


Fig. 3



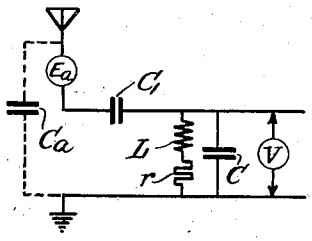


Fig. 4

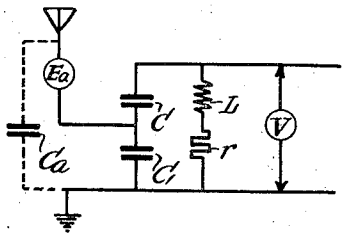


Fig. 5

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ANTENNA COUPLING

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3 Claims. (Cl. 250—20)

This invention relates to receiving sets and particularly to a novel method of connecting antennæ to receiving sets. In order to obtain the desired loose coupling between the antenna and the receiving set, the antenna is often connected through a small condenser to the tuned input circuit of the receiving set. This coupling is stronger in the case of high frequencies than in the case of low frequencies.

Similarly in the high frequency part of the receiving set the high frequencies are generally more amplified than the low frequencies. The present invention relates to a device by means of which the antenna coupling is frequency-dependent in the opposite sense so that it is possible with a correct adjustment to obtain altogether a linear amplification throughout a large region of frequencies.

According to the invention, use is made of an antenna coupling in which the antenna is earthed across a condenser having connected in parallel to it an inductance and a variable condenser in series. If in this case the former condenser is large as compared with the latter, the coupling between the antenna and the set is very loose.

In order that the invention may be clearly understood and readily carried into effect three embodiments thereof will now be described more fully with reference to the accompanying drawing. In the drawing Figure 1 illustrates one form of the invention wherein a variable capacity is shown connected across the grid and cathode of an electronic tube. Figure 2 is another form of the invention wherein an inductance coil is connected between the grid and cathode of an electronic tube. Figure 3 shows a preferred form of the invention adapted for connection to both long and short antennæ and Figures 4 and 5 are circuit diagrams which are utilized to explain certain features of the invention.

Referring to Figure 1, A is an antenna earthed across a condenser C_1 having connected in parallel to it an inductance coil L and a variable condenser C in series. The circuit LCC_1 is in syntony with the frequency to be received. If in this case C_1 is large as compared with C, a loose coupling to the antenna is secured. The condenser C_1 may be shunted by a resistance R by means of which a direct current connection to the grid of the first valve is obtained so that this grid can be adjusted to a given potential. The resistance R must be so large that it does not produce any damping of the tuned circuit.

In the circuit arrangement shown in Figure 2 a coil L is connected between the grid and the cathode, whereas the condenser C is arranged between the grid and the antenna. The resistance R is here not required, as the potential of the grid can be adjusted across the inductance coil. In this circuit arrangement the condenser C is not possessed of earthed plates so that more care is required for the arrangement that with the circuit arrangement shown in Figure 1.

It may be desirable that the receiving set should be constructed so as to be independent of the capacity of the antenna to which it is connected. So long as the capacity of the antenna is feeble, its influence on receiving sets having a coupling according to the invention is but small. If, however, the aerial capacity is larger, a greater capacity is connected parallel with the condenser C. The influence thereby produced can be limited by the arrangement of a condenser C_2 between the antenna and the receiving set (Figure 2).

A further circuit arrangement by means of which a receiving set is rendered suitable for connection to a long as well as a short antenna is shown in Figure 3. A switch S permits of the antenna A being connected through a contact *a* and a small condenser C_3 to the tuned circuit LCC_1. This position is chosen when the antenna is long. In the case of a short antenna, S is connected to *b* and C_1 acts as a coupling condenser, whereas C_3 is cut out of circuit.

The tuning of the circuit LCC_1 may be identical in both cases.

When using a receiving set having a plurality of tuned circuits, preferably a fixed condenser corresponding to C_1 is included, in series with the variable condenser, in each of the tuned circuits. In the case all the rotary condensers may be of uniform size and seated on a single spindle.

The operation of the systems discussed above will now be taken up in connection with Figures 4 and 5.

Defining the amplification of the system as

$$\frac{V}{E_a}$$

where V is the electromotive force occurring between the input electrodes of the first valve and where E_a is the electromotive force induced in the antenna, the advantages of the arrangement of the invention will be best understood by comparing a system such as shown in the specification with one of the known arrangements. Considering Figure 4 below which shows an antenna coupling which has hitherto been used, it will be seen that the antenna is coupled to the tuned circuit L, C, *r* by a small condenser C_1. C_a represents

the antenna capacity and E_a represents the E. M. F. induced in the antenna. If the circuit L, C, is tuned to the frequency to be received, then it is well known that,

$$\frac{V}{E_a}=j\omega\frac{C_1C_a}{C_1+C_a}\cdot\frac{\omega^2L^2}{r}$$

In this formula, C_1C_a and L are constants whereas ω and r vary with the frequency. Ordinarily r is about directly proportional to the frequency. It will be seen from the above equation that with the arrangement shown in Figure 4 the amplification varies with the quadrate of the frequency. In Figure 5, there is shown an arrangement in accordance with the invention.

In this case,

$$\frac{V}{E_a}=\frac{C_a}{C_a+C_1}\cdot\frac{j\omega L}{r}$$

From the above it will be seen that as r varies proportional with the frequency, that is, proportional with ω the expression on the right hand side of the equality sign is not dependent on the frequency. Thus, the amplification is linear. From the above it will be clear that the frequency dependency is not affected by the magnitude of the condenser C_1 although the coupling is dependent upon the magnitude of this condenser.

I claim:

1. A tunable input system for an electronic tube amplifier adapted to be connected to either long or short antennæ for the reception of signalling energy of widely different frequencies comprising in combination, a tuned circuit including a fixed condenser, an inductance and a variable condenser connected in the order named in loop fashion, a pair of auxiliary terminals, a connection between one of said terminals and a point of said loop circuit intermediate the variable condenser and the inductance, said connection including a coupling condenser, a connection between the other of said terminals and a point of said loop circuit intermediate the variable condenser and the fixed condenser, an antenna terminal and a selector means for connecting said antenna terminal to either of said auxiliary terminals, said antenna terminal being connected to one of said auxiliary terminals when the input system is connected to a comparatively long antenna and to the other of said auxiliary terminals when the system is connected to a comparatively short antenna.

2. A system as described in the next preceding claim wherein one of the first two named condensers is of comparatively large capacity with respect to the other thereof.

3. A tunable input system for an electronic tube amplifier adapted for the reception of signalling energy of widely different frequencies and to provide a substantially flat amplification characteristic irrespective of the frequency received comprising in combination, a tuned circuit including in series a fixed capacity, a variable capacity and an inductance element connected in loop fashion, means for connecting said system to an antenna comprising a selector switch arrangement for connecting said last named means across the fixed capacity when a comparatively long antenna is utilized and across both capacities when a comparatively short antenna is utilized, one of said connections being made directly, a capacitive coupling element and means for making the other of said connections through said capacitive coupling element.

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