Dec. 1, 1936. J. VAN SLOOTEN 2,062,434

RADIO RECEIVING SYSTEM

Filed Aug. 18, 1932

Fig. 1

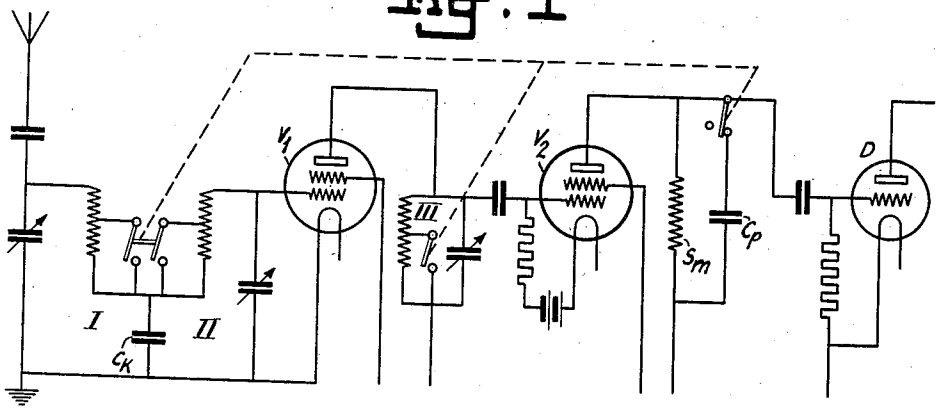


Fig. 2

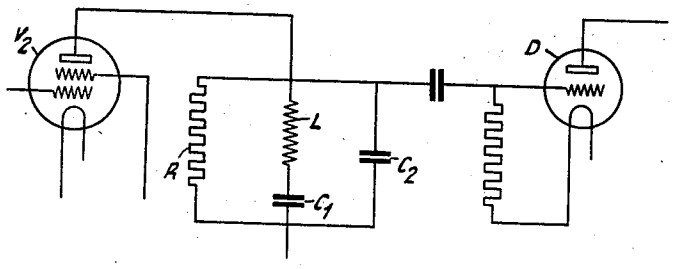
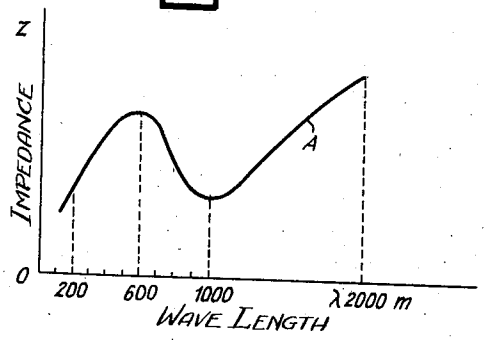


Fig. 3



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RADIO RECEIVING SYSTEM

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7 Claims. (Cl. 178—44)

With certain known receiving circuit arrangements of the type having tuned circuits both the selectivity and the sensitivity vary rather highly with the frequency to which said circuits are tuned.

By the influence of the properties of the coils and that of various damping effects this variation usually occurs in such a sense that the sensitivity is greater with the high frequencies, whereas the selectivity is less than in the case of receiving low frequencies.

The present invention has for its purpose to provide an arrangement in which this drawback is entirely or greatly avoided.

The invention consists in a combination with one or more of the tubes pertaining to the arrangement, of a complex of two or more tuning circuits interposed, preferably before the first tube, said circuits being coupled together capacitively.

The effect thus obtained will be described hereinafter and according to the invention it may be partially increased by using a quasi-aperiodic system as coupling element in one or more of the succeeding high frequency stages, said system having a smaller impedance for the high frequencies than for the low frequencies of the wave length range.

For apparatus having two ranges of wave lengths (so-called long and short wave) this quasi-aperiodic system may in accordance with the invention be composed in such a way that the impedance decreases between the longest wave of the short waves and the shortest wave of the long waves, whereupon it increases again.

A constant sensitivity in one frequency range may be obtained by using a quasi-aperiodic coupling system having a resonant frequency in the vicinity of the lowest frequency of the frequency range. In this case, however, the sensitivity is not constant in another frequency range. Therefore, according to the present invention a switching arrangement is provided in the quasi-aperiodic circuit which is adapted to insert a capacity in this circuit. If the coupling circuit is of the choke coil type the choke coil is arranged so as to have a resonance frequency which lies in the vicinity of the lowest frequency of the short wave range. It is thus seen that when the capacity is not inserted in the circuit the sensitivity of the receiver is constant in the short wave range. When, however, frequencies lying within the long wave range must be amplified, the capacity is switched in; in this case the resonance frequency of the quasi-aperiodic circuit is made to lie within the vicinity of the lowest frequency of the long wave range and a constant amplification of all frequencies lying within this long wave range will be obtained. In another arrangement of the invention two parallel paths are connected across the coupling impedance one of which favors long waves. The other parallel path is in effect a tuned circuit which is tuned to a point somewhere between the two frequency ranges. This arrangement prevents the sensitivity increasing from one end of one frequency range to the other end of the other frequency range.

The invention will be more clearly understood by reference to the accompanying drawing, representing, by way of example, one form of construction thereof.

Fig. 1 shows the principle diagram of the receiver so far as it is of importance for the invention.

Fig. 2 is a modified form of construction of the quasi-aperiodic coupling.

Fig. 3 is a graphical view of the impedance of the coupling as shown in Fig. 2.

The arrangement represented in Fig. 1 comprises two high frequency valves V_1 and V_2 and a detector D. The succeeding low frequency part to which the invention does not bear relevance, is not represented.

Between the antenna and the first valve V_1 are inserted two tuning circuits I and II having a common coupling condenser C_k. The effect of this capacitive coupling is that it becomes looser with an increasing frequency so that the selectivity increases, whereas the sensitivity decreases, this being just the result to be achieved. Especially the influence on the selectivity is great, so that with well constructed tuning coils an almost constant selectivity over the whole range of wave lengths may be obtained by using this part of the invention.

On the other hand the influence on the sensitivity is less great, so that it is desirable to take still further measures in this respect.

This has been done in the diagram shown in Fig. 1 by using a coupling between the valve V_2 and the detector D consisting of a choke coil S_m with a parallel condenser C_p which may be switched off. The choke coil is so constructed that its resonant point lies just above the longest wave of the short waves. When receiving in this range the condenser C_p is switched off.

The latter is so large that the circuit S_m—C_p resonates just above the longest wave range. Within this range the condenser C_p is switched in.

If it is desired to avoid the switching in and off of the condenser C_p the arrangement shown in Fig. 2 may be used.

To a coupling resistance R two paths are connected in parallel, viz. the path L—C_1 and the path through C_2. The latter path in itself favors the long waves. In order to prevent the sensitivity of the circuit from continually increasing between 600 m. and 1000 m. and to assure that the sensitivity at 1000 m. is about the same as the sensitivity at 200 m., the path LC_1 is tuned to about 1000 m. The resonance curve A of the system represented in Fig. 3 shows consequently a fall between 600 m. and 1000 m. whereupon it ascends again.

By taking the above measures either separately or in combination either the selectivity or the sensitivity or both may be kept substantially constant over the whole range of wave lengths for which a receiving set is constructed.

If desired, it is also possible to use both measures or one of them several times in the same arrangement, if circumstances should give rise thereto.

I claim:

1. In an amplifier, an electrical arrangement of the type which is adapted to be connected with an electronic relay, said electrical arrangement including input terminals and output terminals, said input terminals being connected to a source of signal energy through a tunable circuit, said tunable circuit being provided with a tuning element adapted to tune the circuit to any frequency within a predetermined range of frequencies and with operable means for adapting said tunable circuit so that it may be tuned to any frequency within another predetermined range of frequencies, said tunable circuit having an inherent rising sensitivity characteristic with increasing frequency to which the circuit is tuned, a utilizing circuit, a circuit including an inductance element for connecting the output terminals to the utilizing circuit, said connecting circuit being resonant at a frequency which is in the vicinity of the lowest frequency of one of said frequency ranges and means, acting upon operation of the operable means to condition the tunable circuit so as to tune to the other range of frequencies, to change the resonance of said connecting circuit so that the connecting circuit becomes resonant at the frequency which is in the vicinity of the lowest frequency of the other of said range of frequencies.

2. In a coupling system for transferring energy from a source of radio frequency energy to the input of an electronic tube, the energy to be transferred through said coupling from said source being of two separated frequency ranges, said coupling system including a load impedance element connected across the source, a pair of parallel paths shunted across said load impedance, one of said paths comprising a condenser, the other of said paths comprising an inductance and a tuning condenser therefor, said latter path being resonant at a frequency which is between said two frequency ranges whereby said coupling system has a rising impedance characteristic with decreasing frequencies along both said frequency ranges and a rising impedance characteristic for increasing frequencies lying between said two frequency ranges.

3. In a multi-range receiver, a tunable radio frequency circuit having input terminals and output terminals, means for connecting the input terminals to a source of radio frequency energy, an electrical network provided with an input circuit and an output circuit, means including a quasi-aperiodic circuit for connecting the output terminals of the radio frequency circuit to the input circuit of the electrical network, selective switching means for altering the characteristics of the radio frequency circuit so as to condition the circuit to tune to any one of a plurality of frequency ranges in accordance with the position of the switching means, said quasi-aperiodic circuit having a natural frequency which is in the vicinity of the lowest frequency of whichever frequency range the receiver is conditioned for.

4. In a multi-range receiver, a tunable radio frequency circuit having an input circuit and an output circuit, said input circuit being provided with means for connection to a source of radio frequency energy, an electrical network having an input circuit and an output circuit, means for coupling the output circuit of the radio frequency circuit to the input circuit of the electrical network including an inductance coil connected across the radio frequency circuit output circuit, said coupling means having an anti-resonant frequency which is in the vicinity of the lowest frequency of one of the frequency ranges for which the receiver is adapted, selective switching means for altering the receiver so as to tune to the various frequency ranges and means operable simultaneously with the operation of the switching means for changing the anti-resonant frequency of the coupling means so that the anti-resonant frequency thereof is always in the vicinity of the lowest frequency of whichever one of the frequency ranges the receiver is adjusted for.

5. In a tunable multi-range receiver, a coupling system for transferring energy from a source of radio frequency to the input of an electronic tube, switching means for adapting the receiver to tune through any one of a plurality of different frequency ranges, a circuit including an inductance coil connected across the source, said circuit having an anti-resonant frequency which is in the vicinity of the lowest frequency of one of said ranges and means acting in conjunction with the switching means when said switching means is operated to change the receiver from one of the frequency ranges to another thereof for altering the anti-resonant frequency to a frequency which is in the vicinity of the lowest frequency of the frequency range through which the receiver is adapted to be tuned.

6. In a tunable multi-range receiver, a coupling system for transferring energy from a source of radio frequency to the input of an electronic tube, switching means for adapting the receiver so as to tune to any one of a plurality of different frequency ranges, circuit means including an inductance coil connected across the source, said circuit means having an anti-resonant frequency which is below the lowest frequency of one of said ranges and means acting in conjunction with the switching means, when said switching means is operated so as to adapt the receiver for tuning to another of the frequency ranges, for changing the natural frequency of the circuit means to a frequency which is in the vicinity of the lowest frequency of the last named frequency range.

7. In a multi-range receiver, a tunable radio frequency circuit having an input circuit and an output circuit, means for connecting said input circuit to a source of radio frequency energy, a relay including an electronic tube provided with an input circuit and output circuit, means in-

cluding a quasi-aperiodic circuit for coupling the output circuit of the tunable radio frequency circuit to the input circuit of the electronic tube, selective switching means for conditioning the receiver to tune to any one of the various frequency ranges depending upon the position of the switching means, said quasi-aperiodic circuit being provided with means to give the circuit a rising impedance characteristic with decreasing frequency for all of the different frequency ranges to which the receiver may be adjusted and an increasing impedance characteristic with increasing frequency between the desired frequency ranges.

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