June 29, 1937. C. J. VAN LOON ET AL 2,085,403

MULTIRANGE RADIO RECEIVER

Filed April 19, 1934

Fig. 1

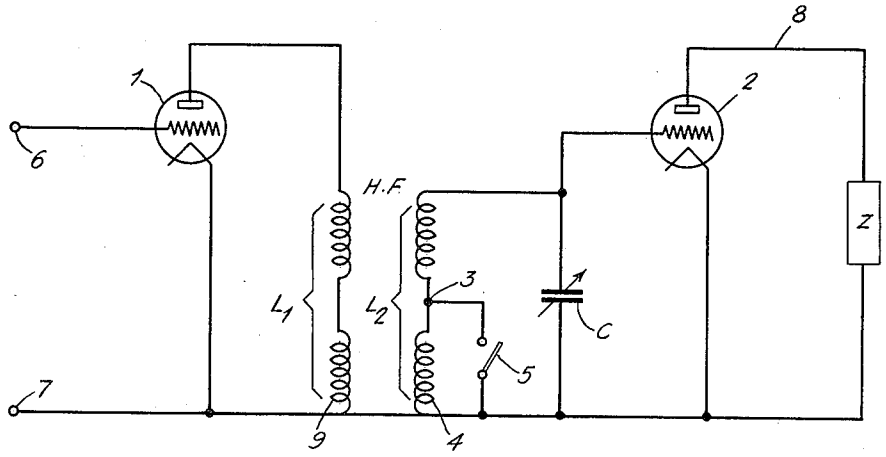
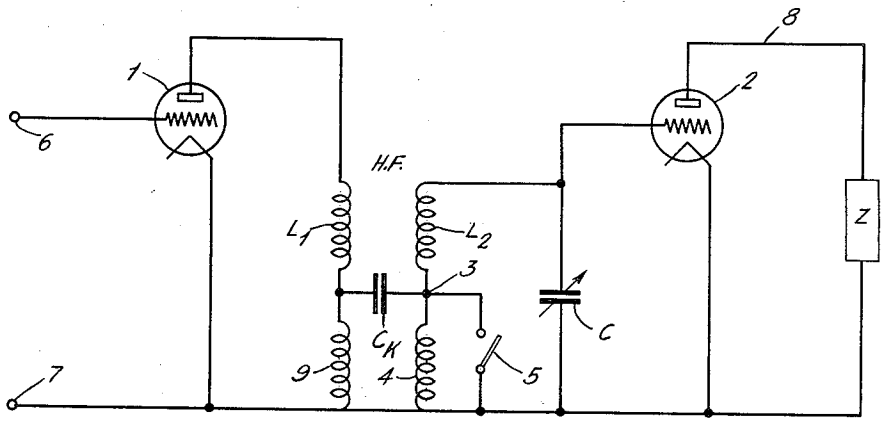


Fig. 2



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MULTIRANGE RADIO RECEIVER

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3 Claims. (Cl. 179—171)

The invention relates to the switching-over of radio-receiving apparatus adapted for the reception of a plurality of wavelength ranges.

The usual method of switching-over a radio receiving device from one range of wavelengths to another, e. g. from the long wave range comprised say between 1,000 and 2,000 meters to the range of shorter waves located between 200 and 600 meters, consists in that for the reception of the shorter waves the coils of the tuned circuits are partly short circuited by means of switches. If the receiver comprises a plurality of high-frequency amplification stages which are inductively coupled to one another, it is necessary in such receivers to furnish a switch for each primary and secondary winding of the high frequency transformers which bring about the inductive coupling. Such a method is attended with the drawback that a large number of switches are necessary, that is to say, at least two switches must be provided for each inductively coupled amplification stage. The present invention provides means which render it possible to employ, in the switching-over of high frequency transformers, a smaller number of switches than has hitherto been possible.

The means according to the invention consists in the use of a high frequency transformer, the coupling factor or coefficient between the primary and secondary windings of which amounts to about 100%, and the secondary coil of which is subdivided into several parts so that in switching-over from long to short waves only part of the secondary coil is short circuited by means of a switch.

For a better understanding of the invention reference is made to the attached drawing in which:

Fig. 1 is a schematic circuit diagram of two radio frequency amplifier stages coupled according to our invention and

Fig. 2 is a schematic circuit diagram of a similar coupling means using a modified form of the invention.

Fig. 1 represents a circuit arrangement comprising two thermionic amplifying valves 1 and 2 which are coupled to one another by means of a radio frequency transformer HF consisting of two coils L_1 and L_2. The primary coil L_1 is included in the anode circuit of the amplifying valve 1 whereas the secondary coil L_2, which may be tuned to the wave-length desired by means of a variable condenser C, forms part of the grid circuit of the amplifying valve 2. The high frequency transformer, consists of a coil which is wound with the aid of a wire consisting of a plurality of conductors (e. g. a stranded wire) and in which a determined number of the conductors or strands are connected in parallel with the other conductors or strands only over part of the coil whereas the other conductors or strands form a particular coil which is denoted in Figure 1 by L_1. The above first mentioned conductors form the coil L_2. By winding the high frequency transformer in this manner one obtains between the primary and secondary windings a very large coupling factor which amounts to about 100%.

The secondary coil L_2 is divided by means of a tap 3 into two parts of which the lower one, 4, may be short circuited by means of a single pole switch 5. For the reception of long waves (2,000 meters) use is made of both parts of the coil whereas for the reception of short waves such as 200 to 600 meters, part 4 of the coil is short circuited by means of the switch 5. It is evident that when part of the secondary coil is short circuited, the part of the primary coil which is coupled to the first mentioned part is at the same time also short circuited because, as has previously been mentioned, the coupling factor or coefficient between these two parts amounts to about 100%. In switching over from long to short waves a switch short circuiting part of the primary winding can therefore be dispensed with, which effects a great simplification in the case of a plurality of inductively coupled amplification stages.

The input terminals 6, 7 of valve 1 are connected respectively to its grid and cathode and may be connected to any desired source of modulated radio frequency currents of a wide range of frequencies such as an antenna. The plate circuit 8 of valve 2 may include any desired load impedance Z.

In the circuit arrangement shown in Fig. 1 the coupling coefficient or factor between the primary and secondary windings of the high frequency transformer has been assumed to be substantially 100%. If, however, the coupling factor is considerably less than this value, it is impossible to obtain a sufficient short circuit of part of the primary winding solely by short circuiting a corresponding part of the secondary winding with the aid of a switch. In this case it may be advantageous to couple both parts to be short circuited to one another by means of a condenser.

Such a circuit arrangement is shown in Fig. 2 in which a condenser C_k is connected between the two parts 3 and 4 of the primary L_1 and the

secondary winding L_2 respectively of a high-frequency transformer HF, which parts are to be short circuited. Such combination of a capacitative and an inductive coupling renders it possible to obtain a coupling factor of about 100% so that if both windings are inductively less tightly coupled it is still possible to obtain a sufficient short circuit of part of the primary winding by giving condenser C_k a low reactance at the high frequencies to be amplified.

Having described our invention, what we claim as novel and desire to secure by Letters Patent is:

1. In an amplifier for a wide range of radio frequencies, the combination of a transformer secondary winding, a variable condenser connected across the ends of said winding, a tap intermediate the ends of said secondary winding, a switching device connected between said tap and one end of said secondary winding, a primary winding arranged adjacent said secondary winding, a condenser having one side connected to an intermediate point of said primary winding and its other side to the tap on said secondary winding and means for impressing a wide range of radio frequency currents on said primary winding.

2. The combination defined in the preceding claim in which the degree of inductive coupling between said primary winding and the end of the secondary winding across which the switch is connected is less than unity.

3. In combination, a transformer secondary winding, a variable condenser connected across the ends of said winding and arranged to tune said winding over a range of radio frequencies, a primary winding arranged adjacent said secondary winding and inductively coupled thereto with a coupling coefficient less than unity, a condenser having a low impedance to radio frequency currents connected between an intermediate point of said primary and an intermediate point of said secondary winding, and means for short circuiting a portion of said secondary winding.

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