

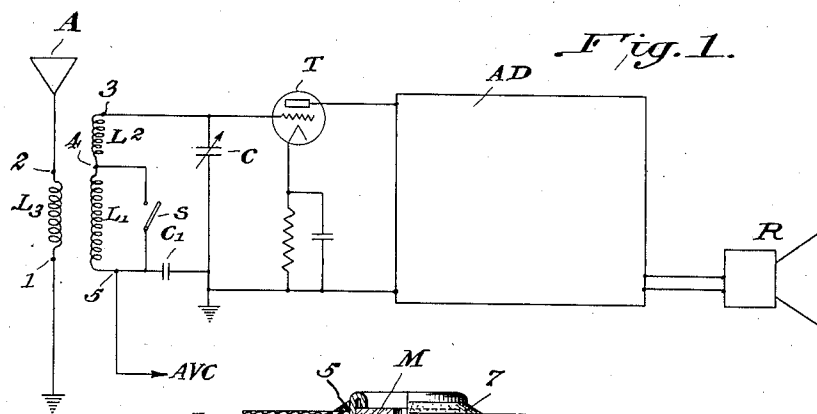
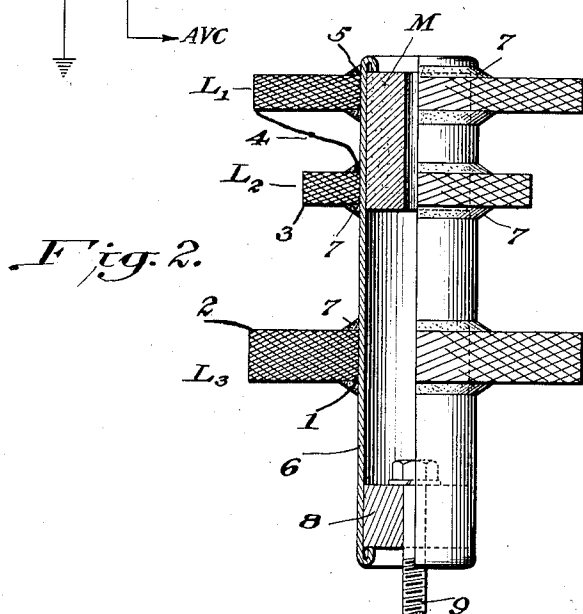
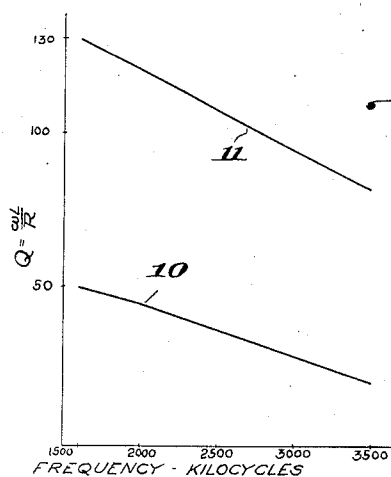
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DUAL BAND ANTENNA TRANSFORMER

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DUAL BAND ANTENNA TRANSFORMER

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8 Claims. (Cl. 250—20)

This invention relates to radio receivers and more particularly to antenna transformers forming part of radio receivers designed for operation on a plurality of frequency bands.

The commercial development of iron-cored radio inductances has resulted in reductions in the size and improvements in the performance of radio receivers. Inductances and transformers of high efficiency have been produced for use in the broadcast and higher frequency ranges, but the same high efficiency was not obtained in the case of iron-cored antenna transformers of the type having a tapped grid coil, one section of the coil being shorted out during the reception of signals in the higher frequency band.

An object of this invention is to provide a radio receiver for operation over a plurality of frequency ranges, the receiver including an iron-cored antenna transformer of such design that the shorting out of a section of the grid coil or transformer secondary is not accompanied by a loss in efficiency. A further object is to provide an antenna transformer for a double range radio receiver, the transformer including an air core primary and a pair of spaced secondary sections on a common magnetic core, the secondary section which is to be shorted out being more remote from the primary than is the secondary section that is tuned over the higher frequency range.

These and other objects and advantages of the invention will be apparent from the following specifications when taken with the accompanying drawing, in which:

Fig. 1 is a fragmentary circuit diagram of a double range radio receiver;

Fig. 2 is a side elevation, partly in section, of an antenna transformer embodying the present invention; and

Fig. 3 is a curve sheet illustrating the relative merits of the novel antenna transformer and one having a single tapped secondary coil.

In the drawing, the reference character A identifies an antenna which is coupled to the vacuum tube T in the input stage of the double range radio receiver through a transformer having secondary sections L₁, L₂ and a primary winding L₃. The secondary is tuned by a condenser C and a switch S is provided for shorting out the secondary section L₁ when the receiver is to be operated over the higher frequency range. The grid will usually be returned, for direct current, to an automatic gain control system, as indicated by the lead AVC, and for radio frequencies is grounded through the condenser C₁. The vac-

uum tube T is illustrated as a simple triode amplifier whose control grid and cathode serve as the input terminals of the receiver. Other types of vacuum tubes may be used in this input stage which works into other amplifier and detector stages which may be of any appropriate design and are indicated schematically by the block AD which precedes the reproducer R.

The described receiver circuits will be recognized as those customarily employed in dual range receivers operating on the broadcast and police bands. As usually constructed, the secondary windings L₁ and L₂ have been a continuous solenoidal winding and, in adapting the iron-cored inductances to this dual range receiver, it was proposed to use a single tapped universal winding on a core consisting of finely divided and insulated iron particles. This arrangement had a good efficiency over the lower frequency range in which the entire coil was used, but had a low efficiency when one section was shorted for reception in the higher ranges.

In accordance with this invention, the sections L₁ and L₂ are arranged, as shown in Fig. 2, at opposite ends of a common cylindrical core M of finely divided magnetic material, and the primary winding L₃ is coaxial with the secondaries and spaced therefrom at the side adjacent the higher frequency range coil L₂. All of the coils are of the universal winding type, and the antenna coil L₃ does not have a magnetic core. The relative arrangement of the coil terminals in the radio circuit is indicated by the reference numerals of Figs. 1 and 2. The inner terminal 1 of the antenna coil L₃ is grounded, while the outer terminal 2 is connected to the antenna. The outer terminal 3 of the high frequency inductance L₂ is connected to the control grid of tube T, the junction 4 of the inner terminal of coil L₂ and the outer terminal of coil L₁ is connected to the contact of switch S, and the inner terminal 5 of coil L₁ is connected to the AVC lead.

In the particular physical assembly shown in Fig. 2, the core M is fitted within the outer end of an insulating tube 6 which may be of paper, and the coil L₁ is approximately aligned with the outer end of the core. Coil L₂ is approximately aligned with the opposite end of the core, and the primary coil L₃ is spaced below the coil L₂ to provide the desired coupling.

In one particular embodiment of the invention, the coils L₁ and L₂ had a combined inductance of 220 microhenries, the inductance of coil L₂ was 40 microhenries, and the inductance of coil L₃ was 2 millihenries. The core and the

several coils may be individually adjusted along the tube 6 to bring the self and mutual inductance of the secondaries to any desired values, and the parts may then be fixed in place by wax 5 7. A dowel 8 is fixed in the lower end of tube 6 and carries a bolt 9 for attaching the transformer assembly to a chassis.

The advantages of the invention will be apparent from a comparison of the curves of Fig. 3. 10 Curve 10 illustrates the relationship between the factor Q, equal to

$$\frac{\omega L}{R}$$

and frequency over a range of from about 1500 15 to 3500 kilocycles, for an iron-cord antenna transformer having a tapped secondary in the form of a single universal winding. The entire coil had a good Q value when used at the lower frequency range but the Q value fell to values 20 of from about 50 to 20 when one section was shorted out by the switch S, Fig. 1. A transformer such as shown in Fig. 2 had a Q value as indicated by curve 11. The Q value is a fair 25 measure of the merit of a radio frequency element and it will be noted that this invention provides a means for materially increasing the efficiency of operation in the higher frequency range of a dual range receiver.

30 It is to be understood that the invention is not limited to the particular frequency ranges or to the values herein given by way of example. Various changes which may be made by those familiar with this art in adapting the principles 35 of this invention to the same or other design requirements fall within the spirit of my invention as set forth in the following claims.

I claim:

1. In a radio receiver adapted to be operated 40 over a pair of frequency ranges, an antenna transformer comprising an air core antenna coil, a pair of serially connected secondary coils spaced at different distances from said antenna coil, a core of magnetic material in substantially fixed 45 position axially spaced from said antenna coil and in the field of said secondary coils, and switch means for short circuiting the secondary coil more remote from said antenna coil.

2. A dual range radio receiver of the type including an antenna transformer having a secondary winding in two sections, means connecting 50 said secondary winding across the input terminals

of the first vacuum tube stage, and switch means for shorting one section of said secondary winding for operation at the higher frequency range, characterized by the fact that said secondary winding comprises two space wound multilayer coils spaced apart along and in substantially fixed position with respect to a single magnetic core.

3. In a dual range radio receiver, the combination with an antenna and an input stage 10 including a multiple electrode vacuum tube, of an antenna transformer comprising three spaced coils in axial alignment, a stationary core of magnetic material within two of said coils, said third coil being a single continuous winding, 15 means for connecting said third coil between antenna and ground, means serially connecting the first two coils between two electrodes of said vacuum tube, and switch means for short circuiting one of said first two coils. 20

4. The invention as claimed in claim 3, wherein said switch means short circuits that one of the first two coils which is the further removed from the third coil.

5. In a double range radio receiver, an antenna 25 transformer comprising an insulating tube, means at one end of said tube for securing the same to a support, a stationary core of magnetic material fixed at the opposite end of said tube, a pair of space wound secondary coils on said tube 30 adjacent said core, and an air core primary coil on said tube and spaced from said core and secondary coils.

6. The invention as set forth in claim 5, wherein the inner terminal of the secondary coil adjacent said primary coil is connected to the outer 35 terminal of the other secondary coil.

7. In a radio receiver, an antenna transformer comprising a paper insulating tube, means at one end of said tube for securing the same to a support, a core of magnetic material fixed within 40 said tube and spaced from the supported end thereof, a pair of space wound coils mounted on said tube about said core and spaced from each other, said coils being serially connected, 45 a tuning condenser connected across said coils, and means coupling an antenna to said coils.

8. A radio receiver as claimed in claim 7, wherein said antenna coupling means comprises an air core universally wound coil mounted on said tube. 50

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