Feb. 22, 1938. P. DE F. McKEEL 2,109,219

ANTENNA COUPLING DEVICE FOR FIVE METER RECEIVERS

Filed Feb. 14, 1935

Fig. 1.

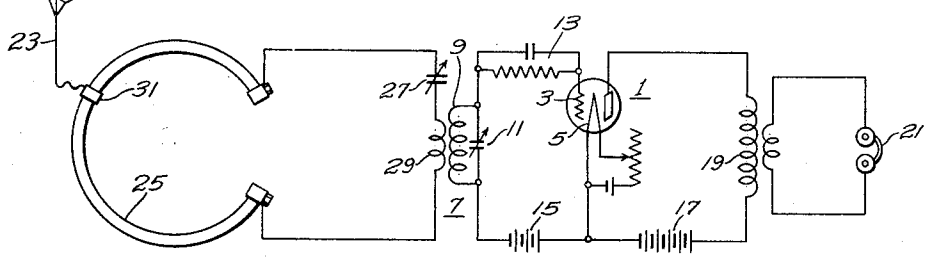


Fig. 2.

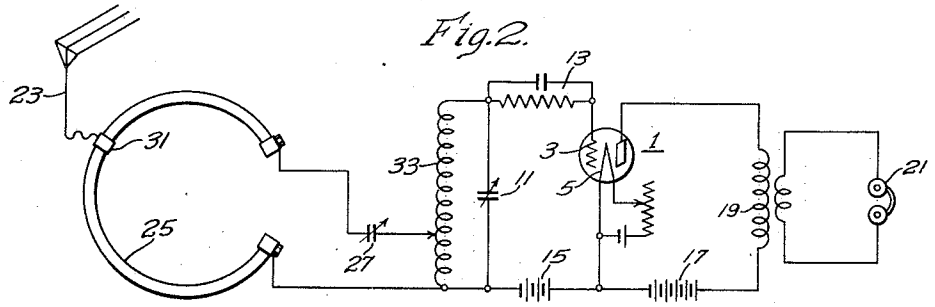


Fig. 3.

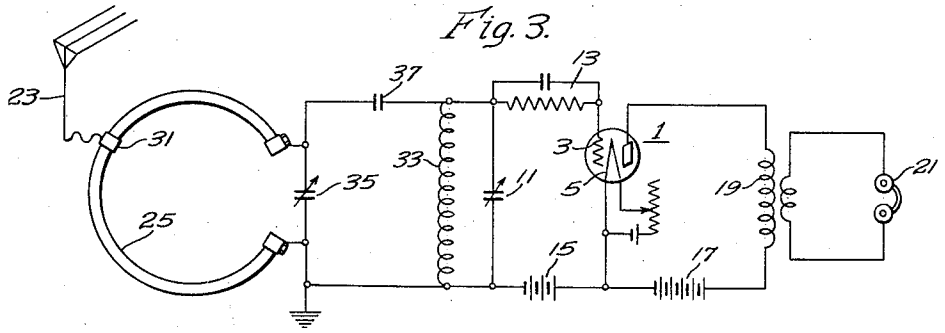
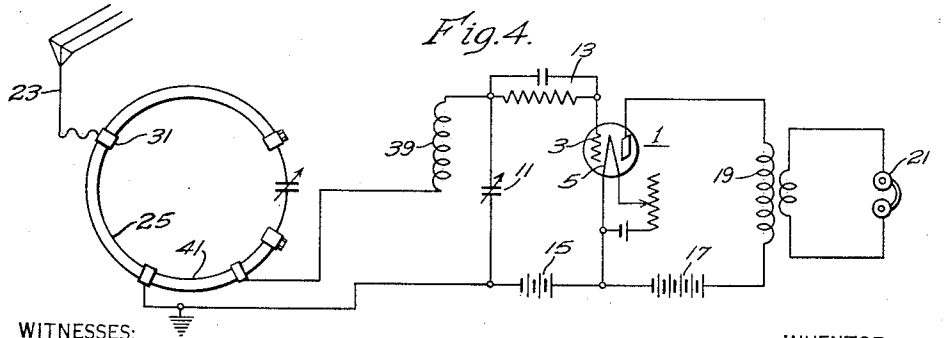


Fig. 4.



WITNESSES:
C. J. Weller.
E. Crocker

INVENTOR
Percy D. McKeel.
BY
F. W. Lyle,
ATTORNEY

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ANTENNA COUPLING DEVICE FOR FIVE METER RECEIVERS

Percy De Forrest McKeel, Springfield, Mass., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

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8 Claims. (Cl. 250—20)

My invention relates to radio circuits, particularly to an adjustable coupling between portions of a circuit designed for operation in the range of the higher radio frequencies. In designing radio circuits it is customary to match impedances between portions of the circuit, such as the various amplifying stages or the coupling between the antenna stage and an amplifying stage whereby to obtain maximum efficiency and output from the apparatus.

A customary manner of accomplishing this throughout a band of frequencies is to provide an adjustable coupling between the stages. When dealing with apparatus tuned for operation in the broadcast band or at lower frequencies, no great problem has been encountered in providing an adjustable coupling for the purpose of matching impedances. One of the common expedients employed was to provide a variable tap connection to the primary side of a transformer.

When operating at the higher frequencies, however, the coupling transformers are, of necessity, composed of but a very few turns, these being quite small in diameter, consequently a shift of from one turn to another is apt to constitute a very high percentage of the number of turns in the primary winding, this, in turn, resulting in a very marked change in the turns ratio of the coupling transformer. The result is that it becomes exceedingly difficult to adjust the turns ratio or other coupling factors whereby to obtain a matching of impedances. The coils being of necessity small in diameter renders it both inconvenient and difficult to utilize a sliding connection on the turns of the coil.

It is an object of my invention, therefore, to provide means whereby the matching of impedances at high frequencies is rendered both convenient and accurate.

Another object of my invention is to provide a coupling means at high frequencies which will be exceedingly simple and efficient.

Additional objects of my invention will be pointed out in the following description, taken in connection with the accompanying drawing wherein Figures 1 to 4 disclose various modifications of a circuit in which I have embodied a coupling means in accordance with my invention.

The circuit of Fig. 1 comprises a conventional detector circuit embodying an electric discharge device 1 of the three electrode type. Between the grid 3 and cathode 5 of this device and constituting the input circuit therefor, we have a tuned resonant circuit 7 comprising an inductor 9 shunted by a variable condenser 11, this resonant circuit being connected in series with a grid leak and condenser arrangement 13 as well as a biasing battery 15. The output circuit including a source of plate potential 17 in series with an inductor 19 is coupled to a pair of phones 21 or other means for interpreting the signals derived from the circuit.

The signal energy is transmitted to the input circuit from an antenna 23 by means of a link circuit comprising a curved conductor 25 in the form of a loop connected in series with a variable condenser 27 and a low inductance coil 29 which is coupled to the input coil 9 of the detector circuit. The antenna is connected to the looped conductor by means of a slidable connection 31 frictionally engaging the conductor 25. This conductor, in combination with the slidable connection from the antenna to the conductor, constitutes the means whereby the impedance of the antenna circuit and the impedance of the succeeding circuits may be matched. This is easily accomplished by shifting the slidable connector along the curved conductor until maximum signal is received in the headphones. This point of maximum signal strength may be more accurately determined through the use of a meter in the plate circuit of the detector. The ease and convenience with which the coupling may be adjusted should be apparent from the diagram and by reason of the fact that the curved conductor comprises the inductance in the circuit and permits of continuous and minute adjustments, a very gradual and accurate adjustment may be obtained. This is exceedingly desirable in the circuits designed for operation at the higher radio frequencies.

To give one an idea as to the dimensions and constants of such a coupling means for a circuit designed to operate at around 5 meters, the primary winding will comprise approximately two turns of a diameter of about 1 inch, the condenser in series therewith will have a maximum capacity of approximately 15 micro-microfarads, and the curved conductor will have a diameter of approximately 8 inches.

It will be apparent from the above that the adjustment of the coupling and the matching of impedances may be easily obtained, and when once located, the slidable connection may be clamped so as to avoid accidental shifting.

The circuit of Fig. 2 is similar to that of Fig. 1, except in that the independent primary winding 29 has been eliminated and the connections leading to this coil have been tapped into the inductance 33 of the tuned input circuit thus providing an auto-transformer effect in lieu of the customary transformer having separate windings.

In the circuits of Figs. 3 and 4, the signal voltage impressed upon the grid is tapped off directly from the loop 25. The manner of obtaining this potential, however, differs slightly in the two circuits. In that of Fig. 3 the potential drop across the tuning condenser 35 is impressed across the tuned input circuit through a coupling con-

denser 37. In the circuit disclosed in Fig. 4 a portion 41 of the tuned loop 25 is included in series with the inductor 39 in the input circuit of the tube 1, the drop in potential across this portion of the loop constituting the signal potential impressed upon the grid of the tube. The connections to the tuned loop in both of the above circuits may be adjustable to obtain any desired variation in signal strength and may, therefore, constitute a means for volume control.

In all of the circuits described above, the antenna is adjustably connected to the tuned loop by some such means as the slidable connection disclosed in Fig. 1, whereby the impedances of the circuits may be very easily and conveniently adjusted for maximum efficiency and output.

While I have disclosed my invention as embodied in various forms as applied to a conventional detector circuit, it should be apparent that the coupling means is adapted for use in any circuit wherein a matching of impedances is desired. I, therefore, do not desire that my invention be limited to the specific details disclosed except as may be necessitated by the prior art and the appended claims.

I claim as my invention:

1. In a system adjusted for operation on short waves, an electron discharge device having an input circuit, coupling means for coupling said input circuit to another portion of said system, said coupling means comprising a winding of such small diameter and of such few turns that the inductance of two adjacent turns is an appreciable portion of the total inductance, and an inductance element in the form of a loop of conductive material connected in series with said winding, said loop having a diameter greater than that of said winding such that distances along said loop may constitute appreciable increments of inductance, and means for connecting said other portion of the system to a point on said inductive loop.

2. In a system adjusted for operation on short waves, an electron discharge device having an input circuit, coupling means for coupling said input circuit to another portion of said system, said coupling means comprising a winding of such small diameter and of such few turns that the inductance of adjacent turns is an appreciable portion of its total inductance, and an inductance in the form of a loop of conductive material connected in series with said winding, said loop having a diameter greater than that of said winding such that its inductance is equal to a substantial portion of the total inductance of said winding, and means for connecting said other portion of the system to a point on said loop.

3. In a system adjusted for operation on short waves, an electron discharge device having an input circuit, coupling means for coupling said input circuit to another portion of said system, said coupling means comprising a winding of small diameter and of such few turns that the inductance of two adjacent turns constitutes a substantial portion of the entire inductance of said winding, and an inductance in the form of a loop of conductive material connected in series with said winding, said loop having a diameter sufficiently greater than that of said winding to constitute an inductance equal to a substantial portion of the inductance of said winding, and means for adjustably connecting said other portion of the system to a point on said loop.

4. In a system adjusted for operation on short waves, an electron discharge device having an input circuit, coupling means for coupling said input circuit to another portion of said system, said coupling means comprising a transformer winding of small diameter and of such few turns that the inductance of two adjacent turns constitutes a substantial portion of the entire inductance of said winding, a condenser and an inductance in the form of a loop of conductive material connected in series with said transformer winding, said loop having a diameter greater than that of said winding, and means for connecting said other portion of the system in slidable engagement with said loop.

5. In a system adjusted for operation on short waves, a link circuit for coupling two portions of said system, said link circuit comprising a coil of small diameter and of such few turns that the inductance of two adjacent turns is an appreciable portion of the total inductance of said winding, and an inductance in the form of a loop of conductive material in series with said coil, said loop having a diameter substantially greater than that of said coil such that substantial and continuous variation of the combined inductance of said coil and said loop may be obtained.

6. In a system adjusted for operation on short waves, a link circuit for coupling two portions of said system, said link circuit comprising a coil of small diameter in series with an inductance in the form of a loop of conductive material, of materially larger diameter than the diameter of said coil, and a connecting means adjustably mounted on said loop, said coil being of such few turns that the inductance of two adjacent turns is an appreciable portion of the entire inductance of said coil, and the inductance of said loop being equal to a substantial portion of the inductance of said coil whereby the combined inductance of said coil and loop may be varied in a continuous manner.

7. In a system adjusted for operation on short waves, an electron discharge device having an input circuit, coupling means for coupling said input circuit to another portion of said system, said coupling means comprising a winding of such small diameter and of such few turns that the inductance between two adjacent turns is an appreciable portion of the total inductance, and an inductance in the form of a loop of conductive material having at least a portion thereof connected in series with said winding, said turn having a diameter substantially greater than that of said winding such that short distances along said loop constitute appreciable increments of inductance, and means for connecting said other portion of the system to a point on said loop.

8. Variable inductance for operation on short waves comprising a winding of a plurality of turns of small diameter and a single loop of conductive material having an inductance equal to a material percentage of the inductance of said winding, said loop having a diameter sufficient to permit substantial changes in the value of the combined inductance obtainable from said winding and said loop, and an adjustable connection to said loop.

PERCY DE FORREST McKEEL.