March 24, 1931. E. L. KOCH 1,797,988

RADIO RECEIVING SYSTEM

Filed June 1, 1926

Fig. 1.

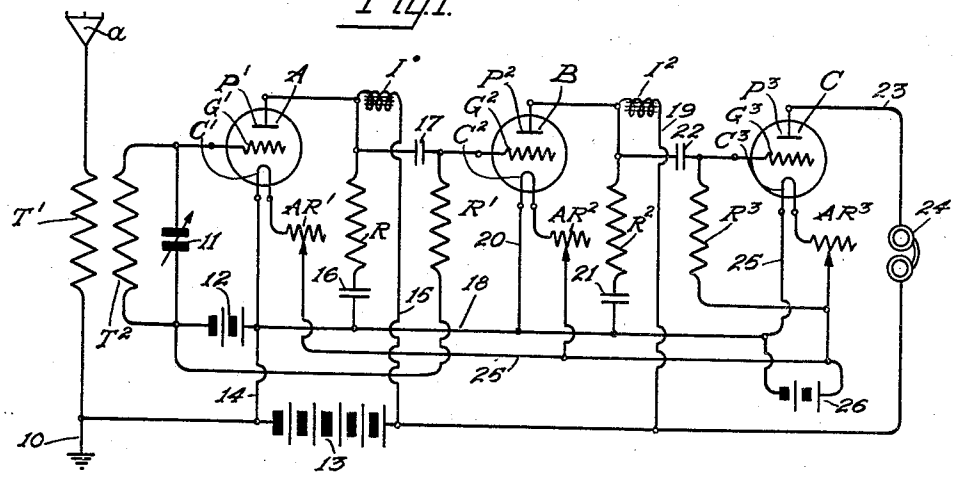
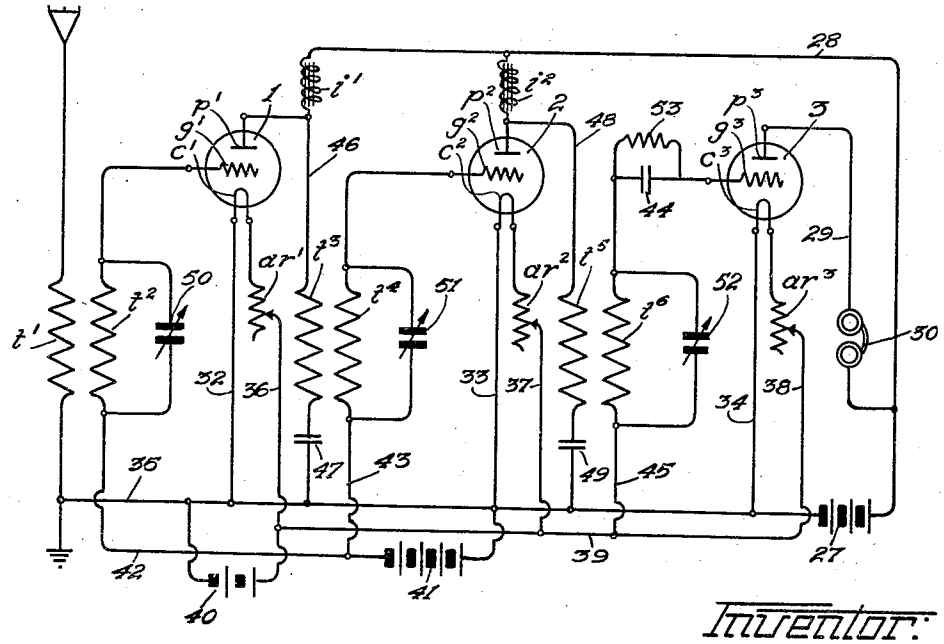


Fig. 2.



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UNITED STATES PATENT OFFICE

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RADIO RECEIVING SYSTEM

Application filed June 1, 1926. Serial No. 112,739.

This invention relates to a radio receiving system and particularly to a system of this character in which improvements are provided in the means for supplying potential to the plate.

In receiving circuits commonly employed, the plate potential is usually applied through a coupling device, usually an impedance or resistance, or a combination of the two. In circuits of this character, the pulsations or oscillations set up in the plate circuit are distributed to a certain extent throughout the entire receiving system, due to the fact that the plate potential is applied through the coupling device.

The object of the present invention, therefore, is the provision of means whereby battery potential is applied to the plate through a circuit independent of the coupling device, whereby the current pulsations set up through the plate circuit are prevented from traversing the entire receiving system.

One of the features of the present invention is the provision of a lead separate and distinct from the coupling apparatus for supplying battery potential to the plate and the provision in such lead of an impedance coil opaque to radio frequency currents whereby the radio frequency oscillations are localized.

It is believed the further disclosure of the invention will be understood most readily from a detailed description thereof taken in connection with the accompanying drawings, in which:

Fig. 1 shows a receiving system of the resistance coupled amplifier type with the present invention applied thereto, and

Fig. 2 illustrates a transformer coupled radio frequency amplifier system having the present invention applied thereto.

Referring now to Fig. 1 of the drawings, *a* indicates the antenna which is joined to ground at 10 through the primary coil T'. Associated with the coil T' is the secondary coil T^2, in parallel with which is the adjustable condenser 11.

In the receiving system herein disclosed, three tubes A, B and C are employed, tubes A and B being radio frequency tubes and C the detector tube. Each of the tubes A, B and C is provided with a plate, grid and cathode indicated at P', G' and C', respectively, at tube A,—P^2, G^2 and C^2, respectively, at tube B,—and P^3, G^3 and C^3, respectively at tube C. Associated with each of the cathodes is an adjustable resistance. These resistances are indicated on the drawing, respectively, as AR', AR^2 and AR^3.

The secondary coil T^2, above refered to, is included in series circuit with the grid G', cathode C' and battery 12. Therefore, the current oscillations set up in the secondary coil T^2 act through the medium of grid G' to vary the resistance between the plate P' and the cathode C'.

The plate supply battery 13 has its negative or grounded pole joined to the cathode C' through conductor 14 and its positive pole joined to the plate P' through conductor 15 and impedance coil I'. It will be noted that the cathodes C', C^2 and C^3 are bridged across the conductors 18 and 25 between which is the battery 26, the adjustable resistances AR', AR^2 and AR^3 being included in series with the cathodes, respectively, in order to control the current flow thereto. Thus the variations in resistance produced by the grid G' cause current pulsations to pass from the cathode C' to plate P'. The impedance coil I' being opaque to radio frequency currents, these oscillations pass in part through resistance coil R and condenser 16 and in part through condenser 17, grid G^2, cathode C^2 in parallel therewith. It will be noted that the condensers 16 and 17 bar the flow of direct current from the positive pole of battery 13. Plate P^2 is provided with battery potential from the battery 13 through the conductor 19 and impedance coil I^2, and cathode C^2 is joined to the negative or grounded pole of battery 13 through conductors 20, 18 and 14.

The current pulsations passing to the grid G^2 act to vary the resistance between cathode C^2 and plate P^2 in the usual manner. Thus radio frequency currents will pass from cathode C^2 to plate P^2, but will not pass through coil I^2. These pulsations will, therefore, pass partly through resistance R^2 and condenser 21 and in part through condenser 22, grid G^3 and cathode C^3 in parallel therewith;

thence through conductor 18 and conductor 20, back to cathode C^2.

The plate P^3 of tube C is joined to the positive pole of battery 13 by conductor 23 in which is included the telephone 24. Cathode C^3 is joined to the grounded pole of battery 13 through conductors 25, 18 and 14. Thus the oscillations through grid G^3 cause current pulsations to pass from cathode C^3 to plate P^3 and through the telephone 24.

As the circuit above described operates in substantially the same manner as conventional receiving circuits, except for the manner of supplying potential to the plate, it is thought that a more detailed description of the operation of this circuit is unnecessary.

Referring now to Fig. 2 which illustrates a transformer coupled system, three tubes, indicated, respectively, as 1, 2 and 3, are provided, tubes 1 and 2 being radio frequency tubes and 3 being a detector tube. Each of tubes 1, 2 and 3 is provided with a plate, grid and cathode, indicated in tube 1 as p', g' and c', respectively, in tube 2 as p^2, g^2 and c^2, respectively, and in tube 3 as p^3, g^3 and c^3, respectively. The plates p', p^2 are joined to the positive pole of battery 27 through conductor 28 and the impedance coils i' and i^2, respectively. Plate p^3 is joined to the positive pole of battery 27 by conductor 29 in which is included the telephone 30.

The cathodes c', c^2 and c^3 each have one terminal joined to ground through the conductors 32, 33 and 34, respectively, which are connected to the grounded conductor 35. The other terminals of the cathodes c', c^2 and c^3 are connected to the live pole of battery 40 through conductors 36, 37, 38, respectively, and the common battery lead 39. The adjustable resistances ar', ar^2 and ar^3 are included in the conductors 36, 37 and 38, respectively, to permit control of the flow of current to the cathodes.

Grid g' is connected to the live pole of battery 41 through the secondary coil t^2 and conductor 42. Grid g^2 is connected to the live pole of battery 41, through the secondary coil t^4 and conductor 43. Grid g^3 is joined to the live pole of battery 40 through condenser 44, secondary coil t^6 and conductors 45 and 39. The plate p' is joined to the grounded conductor 35 through conductor 46, primary coil t^3 and condenser 47. Plate p^2 is connected to the grounded conductor 35 through the conductor 48, primary coil t^5 and condenser 49. In parallel with the secondary coils t^2, t^4 and t^6 are the adjustable condensers 50, 51 and 52, respectively. The grid leak 53 is arranged in parallel with the condenser 44.

The current oscillations passing through the primary coil t' from the antenna, set up oscillations in the circuit including the secondary coil t^2, grid g', cathode c', conductors 32 and 35, battery 41 and conductor 42 and back to secondary coil t^2, thus varying the resistance between the cathode c' and plate p'.

Radio frequency oscillations or impulses will now pass from the cathode to the plate, but the impedance i' being opaque to these oscillations, they will pass through conductor 46, primary coil t^3, condenser 47, conductor 35 and conductor 32, back to the cathode c'.

The pulsations through the coil t^3 inductively affect the secondary coil t^4 causing current pulsations to pass through the grid g^2, cathode c^2, conductor 33, battery 41 and conductor 43 and back to coil t^4. This operates to vary the resistance between the cathode c^2 and plate p^2, causing radio frequency currents to pass from cathode c^2 through plate p^2, conductor 48, primary coil t^5, condenser 49 and conductor 33, back to the cathode.

The current variations through the coil t^5 act inductively on the secondary coil t^6 causing current pulsations to pass from battery 40 through conductor 39, conductor 45, coil t^6, condenser 44, grid g^3, cathode c^3, conductor 34 and conductor 35 and back to battery 40. The current pulsations through the grid g^3 causes impulses or oscillations of current to pass from battery 27 through conductor 34, cathode c', plate p^3, conductor 29 and telephone 30 and back to battery 27.

It will thus be seen that by supplying potential to the plates of the radio frequency tubes through impedance coils opaque to radio frequency currents, the current oscillations are substantially isolated and effectively prevented from permeating the entire receiving system. Due to the fact that the connections to the plates from the batteries 13 and 27 are free from the inductive connections, a somewhat lower voltage battery may be employed. Also, as the radio frequency oscillations traverse a circuit free from the resistance of battery, greater amplification may be obtained.

While the present application shows the invention applied to but two types of receiving circuits, it is to be understood that it may be employed in systems differing widely from those herein disclosed, both in the character of the circuits of the radio frequency amplifiers, as well as in systems employing audio frequency amplifiers. But when employed with audio frequency amplifiers the impedance coils need not be provided in the leads supplying battery potential to the plates. The invention, therefore, should be limited only by the scope of the appended claims.

Having thus described my invention, what I claim is new and desire to secure by Letters Patent of the United States is:

1. A circuit combination including a pair of vacuum tubes provided with cathode, grid and plate elements for amplifying high frequency currents, a source of potential having its one pole connected directly to the

cathodes of said tubes, an individual high frequency choke coil connected between each of said plates and said source of current for preventing high frequency currents from passing through said connections to said source of potential, another connection extending directly from the plate of one of said tubes to the cathode of said tube and including a resistance and a capacity for completing the plate cathode circuit, a third circuit extending directly from the plate of said first tube to the grid of said second tube and including only a condenser, and biasing circuit for the grid of said second tube extending directly from said grid to the cathode of said first tube and including potentializing means.

2. A radio receiving amplifying circuit including a pair of radio amplifier tubes provided with cathode, grid and anode elements, a source of plate potentializing current having its one pole connected to the cathodes of said tubes, a connection extending directly from the plate of said first tube to the other pole of said source of current, an impedance coil opaque to radio frequency currents in said connection for preventing high frequency currents from passing through said source of current and to other parts of said circuit, a connection extending from the plate of said first tube to the grid of said second tube and including only a device for passing radio frequency currents but for preventing direct currents from reaching said grid, a connection extending directly from the plate of said first tube to the cathode thereof including a resistance and a condenser, and a connection extending from the grid of said second tube to the cathode of said first tube and including a source of biasing current for said grid.

Signed at Chicago, in the county of Cook and State of Illinois, May, 1926.

EARL L. KOCH.