

March 11, 1924.

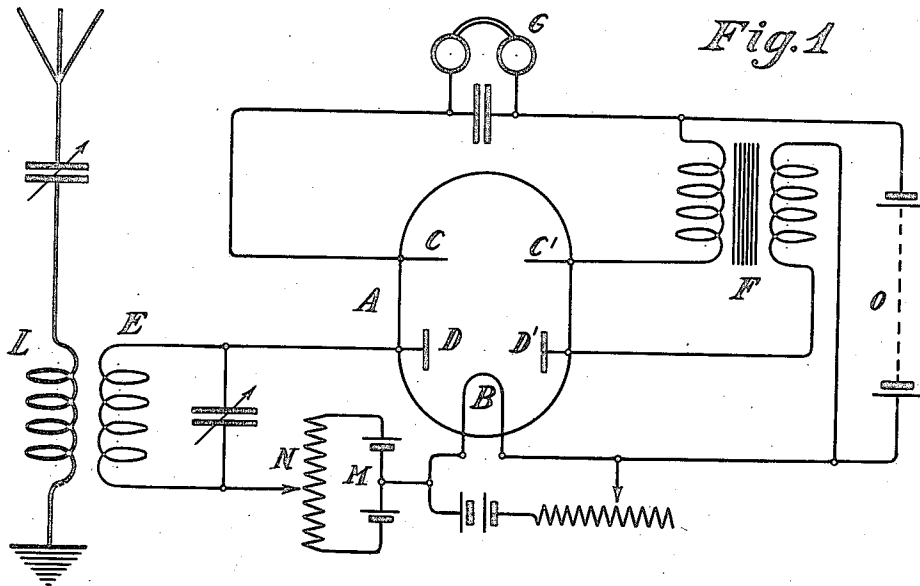
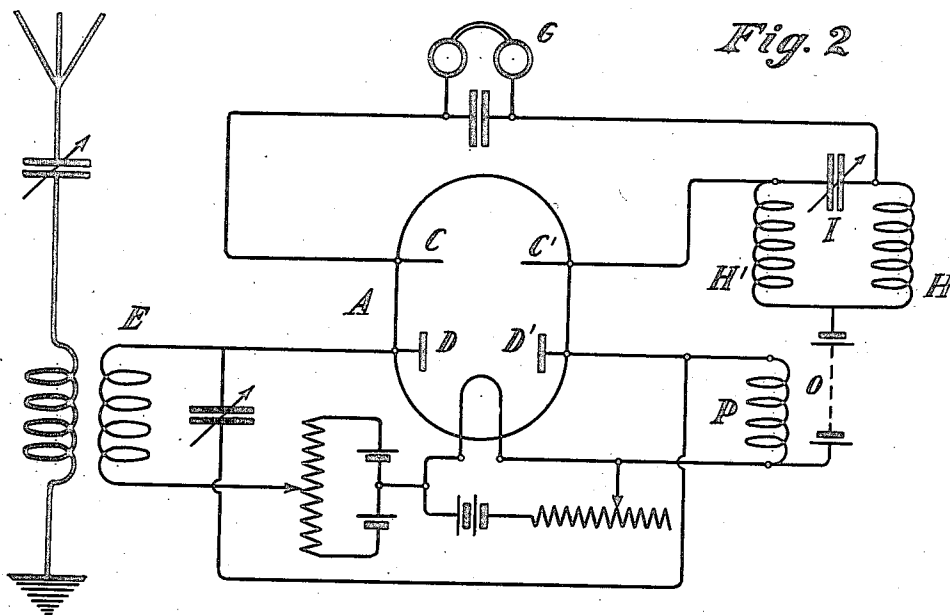
E. BERRY

1,486,221

MEANS FOR CONTROLLING THE FLOW OF ELECTRONS IN ELECTRIC DISCHARGE DEVICES

Filed March 5, 1921

2 Sheets-Sheet 1



Inventor
EDGAR BERRY

By his Attorney *Geo. J. Adams*

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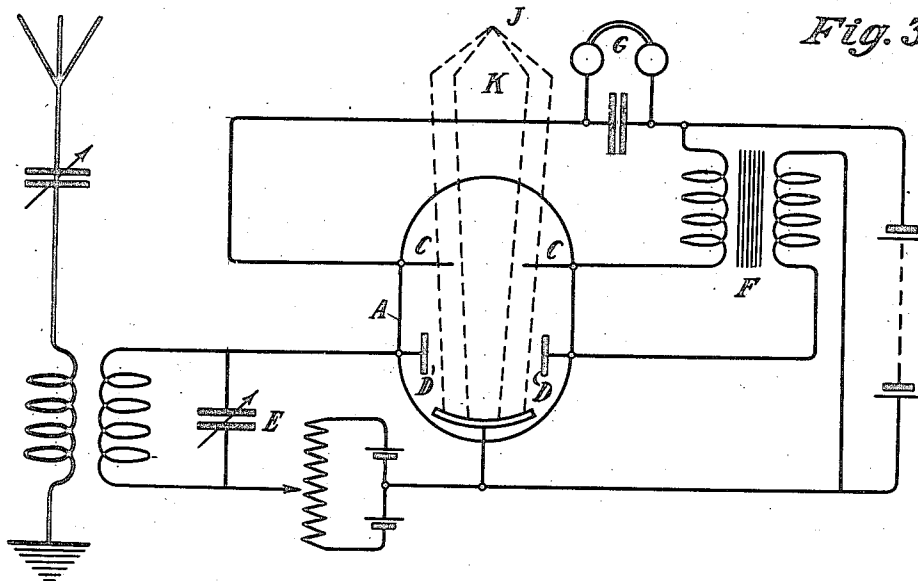
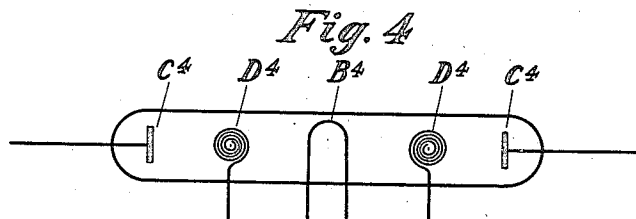
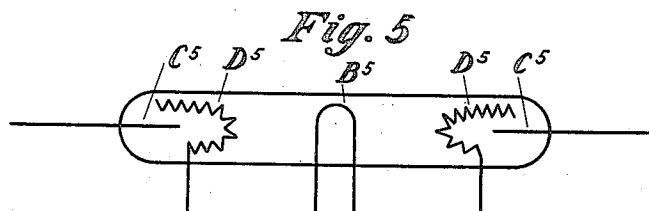
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2 Sheets-Sheet 2



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By his Attorney

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UNITED STATES PATENT OFFICE.

EDGAR BERRY, OF BUENOS AIRES, ARGENTINA, ASSIGNOR TO RADIO CORPORATION OF AMERICA, A CORPORATION OF DELAWARE.

MEANS FOR CONTROLLING THE FLOW OF ELECTRONS IN ELECTRIC DISCHARGE DEVICES.

Application filed March 5, 1921. Serial No. 450,052.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1918.)

To all whom it may concern:

Be it known that I, EDGAR BERRY, a citizen of Great Britain, residing at Buenos Aires, Argentina, have invented new and useful Improvements in Means for Controlling the Flow of Electrons in Electric Discharge Devices (for which I have filed applications in Great Britain February 14, 1919, and Argentina January 21, 1919), of which the following is a specification accompanied by drawings.

This invention relates to improved means for controlling the flow of electrons in thermionic valves used in the reception of wireless signals.

According to this invention I employ for the reception of wireless signals a vacuum vessel containing an electrically heated cathode or other body capable of emitting electrons, a pair of anodes and two plate electrodes located either within or without the vessel and arranged one on each side of the path between the cathode and the anodes so as to apply a potential to the path of the electrons which are thereby caused to fall on the two anodes alternately.

The invention is illustrated by the accompanying diagrams in which

Fig. 1 shows a receiving arrangement embodying the invention whereby radio and audio frequency may be obtained.

Fig. 2 shows a similar arrangement whereby radio frequency may be obtained.

Fig. 3 shows an arrangement in which a spherical concave mirror is used in place of a filament.

Figs. 4 and 5 illustrate in a diagrammatic manner two modified forms of tubes.

Referring particularly to Fig. 1, A is a valve containing a heated filament B and two anodes C, C'; on each side of the path between the filament and the anodes is a plate electrode D, D'. The plate D is connected to one side of an oscillatory circuit E coupled to the antenna L. The middle point of a battery N is connected to one terminal of a filament B and the battery is shunted by a resistance M which is connected to the other side of the oscillatory circuit by means of an adjustable contact. The plate D' and the other terminal of the filament B are connected together through

one winding of a transformer F; the anodes C, C' being connected to the other winding of the transformer and the telephone G. The battery O is connected across the filament and the telephone.

By means of the arrangement described a potential is alternately applied to the path of the electrons which are thereby caused to fall on the two anodes alternately in a manner which may be explained as follows.

When the circuit E oscillates by induction from the aerial L, the plate electrode D will be changing its potential at radio frequency, and by its electrostatic induction to the other plate electrode D'; this latter will also change its potential but with the opposite sign, the effect of this will cause the electrons shot off from the filament to fall on, or oscillate at radio frequency from anode C to anode C', alternately.

Since electrons are negative charges they absorb or neutralise the positive charge on the anodes C and C', and the battery O will now replenish the charge, or in other words, will cause a positive current to flow from the battery O alternately to anodes C and C'; i. e. through the condenser shunting the telephones and through the secondary of the transformer F.

The condenser shunting the telephone will discharge through the telephone at audio frequency, i. e. at a frequency depending on the inductance of the telephone circuit and the capacity of the shunting condenser. This audio frequency will react on the secondary and primary of the transformer, causing the plate electrode D', connected to it, to change its potential also at audio frequency. D' will also react on the beam of electrons, and will thus be again magnified in the telephone.

It will thus be seen that the valve is double acting and that at each complete oscillation two impulses are received on the anode circuit while the filament remains neutral throughout. In this manner it has been found that greater amplification is secured than with two original valves and that the valve will oscillate with less potential in the anode circuit than in other types.

This circuit (Fig. 1) is best adapted for

the reception of damped waves or signals from a spark transmitting station.

The modification of Fig. 2 is quite similar to that of Fig. 1 in its operation and construction. In place of the anodes C, C' being connected through one winding of the transformer the anode C is connected through the telephone G to an inductance H and the anode C' is connected to an inductance H', the ends of the inductances H, H' to which the anodes are connected being shunted by a variable condenser I. The circuit I, H, H' will be tuned to the same frequency as the oscillatory circuit E. The other ends of the inductances are connected through the battery O to the filament B as in Fig. 1. An inductance coil P connected across the plate D' and the filament is shown in inductive relation to the coil H'. The plates D, D' are connected to opposite sides of the variable condenser of the oscillating circuit E.

The system described differs from the one previously set forth in that pure radio frequency is fed back by the inductance of the coil H' on the coil P; the effect of this is to increase the potentials to opposite signs respectively and simultaneously on both the plate electrodes D and D' causing great magnification of the radio frequency. On slightly mistuning one of the circuits and making the beat frequency coincide with that of the telephone circuit, very great amplification is obtained. This circuit is therefore best adapted for the reception of undamped or continuous waves.

In the modification of Fig. 3 the circuits are the same as Fig. 1 except that the source of electrons consists of a spherical concave mirror having its center of curvature between the anodes C, C'; the mirror being silvered with amalgam of potassium and sodium and illuminated from above by a flame or other light J and a lens K.

In Fig. 4 the plates C⁴ are located at opposite ends of the tube, the filament B⁴ being in the center and spiral grids D⁴ are arranged between the filament and the plates.

In Fig. 5 the grids D⁵ are in the form of ruffled sheets or wires which more or less completely shield the plates C⁵ from the electrons emitted by the filament B⁵.

Having described my invention, what I claim is:—

1. In a receiver for wireless signals, the combination of a thermionic valve having in it a cathode, two anodes and a pair of plate electrodes arranged one on each side of the path between the cathode and the anodes so as to deflect the electrons emitted from the cathode on to the two anodes alternately, a receiving circuit connected to the electrodes and a detector connected between the anodes.

2. In a receiver for wireless signals, the

combination of a thermionic valve having in it a cathode, two anodes and a pair of electrodes arranged one on each side of the path between the cathode and anodes so as to deflect the electrons emitted from the cathode on to the two anodes alternately, an input receiving circuit connected to the electrodes, an output detector circuit connected between the anodes and means for coupling the output circuit to the input circuit.

3. In a receiver for wireless signals, the combination of a thermionic valve having in it a cathode, two anodes and two plate electrodes arranged one on each side of the path between the cathode and the anodes, an input oscillatory circuit connected to the electrodes, a transformer, the primary of which is connected to the plate electrodes, while the secondary is connected to the anodes, and a detector connected to the anodes.

4. In a receiver for wireless signals, the combination of a thermionic valve having in it a cathode, two anodes and two plate electrodes arranged one on each side of the path between the cathode and the anodes, an oscillatory circuit connected to the electrodes and a secondary oscillatory circuit and a detector both connected to the anodes.

5. In a receiver for wireless signals, the combination of a thermionic valve having in it a cathode, two anodes and two plate electrodes arranged one on each side of the path between the cathode and the anodes, an input oscillatory circuit connected to the electrodes, a second oscillatory circuit connected to the anodes, a detector connected between the anodes, and means for coupling the second oscillatory circuit to the input circuit.

6. In a receiver for wireless signals, the combination of a thermionic valve having in it a cathode, two anodes and a pair of electrodes arranged one on each side of the path between the cathode and anodes so as to deflect the electrons emitted from the cathode on to the two anodes alternately; a receiving coil connected to one of the electrodes and to the cathode; a second coil connected to the other electrode and to the cathode, and an output detector circuit connected between the anodes.

7. In a receiver for wireless signals, the combination of a thermionic valve having in it a cathode, two anodes and a pair of electrodes arranged one on each side of the path between the cathode and anode so as to deflect the electrons emitted from the cathode on to the two anodes alternately, a receiving coil connected to one of the electrodes and to the cathode, a second coil connected to the other electrode and to the cathode, and an output detector circuit connected between the anodes coupled to one of said coils.

EDGAR BERRY.