

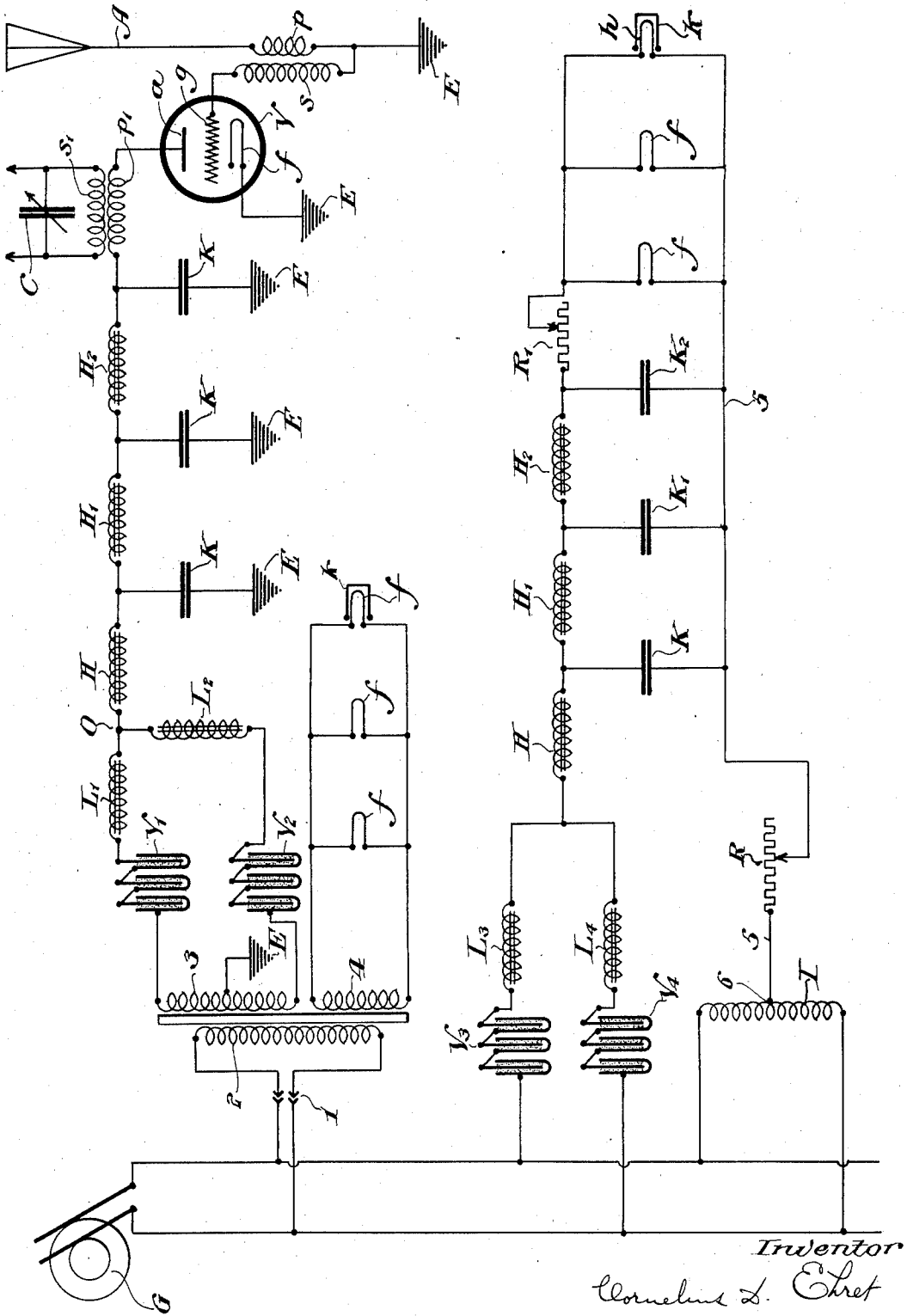
Aug. 15, 1933.

C. D. EHRET

1,922,155

RADIO RECEIVING APPARATUS

Original Filed July 19, 1928



UNITED STATES PATENT OFFICE

1,922,155

RADIO RECEIVING APPARATUS

Cornelius D. Ehret, Philadelphia, Pa.

Application July 19, 1928, Serial No. 293,951
Renewed March 16, 1933

6 Claims. (Cl. 250-27)

My invention relates to radio receiving apparatus, particularly such as employ thermionic devices of the audion type requiring substantially uni-directional current for their anode circuits and for their filaments, cathodes or cathode heaters requiring currents of suitable characters.

In accordance with my invention power from an alternating current source is supplied through a rectifying-filter system to supply anode circuit current for the vacuum tube or tubes, and for the valve structure there is utilized such type as permits substantial inverse current exemplified for example by the electrolytic rectifiers, and particularly, and preferably, by the copper-cuprous oxide or similar type.

Further in accordance with my invention current for the filaments, cathodes or cathode heaters of thermionic devices of the character referred to is a rectified filtered current derived from a source of alternating current through valve structure of the character above referred to.

My invention resides in a method and apparatus of the character hereinafter described and claimed.

For an understanding of my invention and for an illustration of one of the various forms it may take reference is had to the accompanying drawing, which is a diagram of a circuit arrangement embodying features of my invention.

Referring to the drawing, A is an antenna or other absorption structure for absorbing electro-radiant energy from the natural media. Between the structure A and earth or counter-capacity E is the primary p of a radio frequency coupling transformer whose secondary s connects to the grid g of a vacuum tube V of the audion type having in addition the filament or cathode f and the plate or anode a .

In the anode circuit of the tube V is the primary p_1 of a radio frequency coupling transformer, preferably having a step-up ratio, whose secondary s_1 is bridged, for example, by a variable tuning condenser C across whose terminals may be connected the grid and filament of the next succeeding tube which may be either a radio frequency amplifier or a detector, the set as a whole comprising one or more radio frequency amplified tubes, a detector and one or more audio frequency stages.

A single tube is illustrated as exemplary of all or a series of tubes arranged as aforesaid.

G is a source of alternating current, for example 110 volts, 60 cycles, to which is connected, as through a lamp socket, attachment plug or the like, indicated at 1, the primary 2 of a trans-

former having a secondary 3 having adjacent its middle a tap connected to earth E. Connected to one terminal of the secondary 3 is the electric valve structure V1 comprising a few cells in series. Similarly there is connected to the other terminal of the secondary 3 a valve structure V2. In series between the valve structures V1 and V2 and the point O are the inductances L1 and L2. Between the point O and the anode a of the tube V are the several choke coils or inductances H, H1, and H2 with intermediate shunt paths to earth E through the condensers K, K1 and K2. These choke coils and condensers form, as well understood in the art, a filter or ripple-suppressing system, the choke coils and condensers having suitable magnitudes which vary among themselves as well understood in the art.

The valve structures or individual cells thereof are of either the wet or dry electrolytic type, the copper-cuprous oxide type, or other equivalent type characterized by the fact that in a non-inductive circuit with a source of alternating current substantial inverse current is permitted to flow, in virtue of the imperfect valve action or imperfect asymmetric conductivity.

However by utilizing suitably high inductance in circuit with each of the valve structures V1 and V2, whereby the ratio of inductive reactance to resistance is high and preferably greater than four or five, and sometimes as much as ten or twenty, the inverse current is materially reduced below what it would be in a non-inductive circuit, and may be reduced to such extent that the ratio of the root means square value of the direct or positive current is upwards of four, and sometimes seven or ten times the root mean square value of the inverse or negative current. For this purpose the inductance L1 serves with respect to the inverse current of valve structure V1, and the inductance effective as to this valve structure is contributed to by the inductance L1 and also by the inductances or choke coils H, H1 and H2. Similarly as to the valve structure V2 the inductance for the purpose aforesaid is contributed to by the inductance L2 and the inductances or choke coils H, H1 and H2. In either case the effective inductance of the valve structure circuit is of the high order or magnitude aforesaid, preferably effecting the high ratio of reactance to resistance above referred to.

Across the extreme terminals of the secondary 3 there may exist a potential difference of about 500 volts or half that voltage is impressed upon each valve circuit with its associated filter system. Notwithstanding such voltages the num-

ber of cells in series, particularly when of the copper-cuprous oxide type, is relatively small. The number is not critical but is preferably small in order that, at the load current, the fall of potential across each valve structure is small as compared with the fall of potential across the impedance of the circuit external thereto, for high efficiency, and this ratio of voltage drops may range from 0.25 to 0.1 or 0.2. The number of cells in series, particularly when of the copper-cuprous oxide type, may be so few with relation to the potential difference between the mid-tap of the secondary 3 and one extreme terminal of the secondary that that voltage divided by the number of cells in series will be at least ten and generally upwards of twenty.

The foregoing relations as to high inductance, high ratio of inductance to resistance, few cells in series, relative magnitudes of potential differences between valve structure and impedance, and ratio of current to rectifying surface are not per se my invention, but are the invention of Carl S. Weyandt, of Pittsburgh, Pennsylvania.

By recourse to valve structures V1 and V2 of the character above described the usual thermionic double wave rectifier valve utilized in alternating current socket power units is dispensed with, with particular advantage in that the current for its cathode or filament excitation is saved, and no extra transformer winding for this purpose is necessary.

Furthermore the valve structures V1 and V2, particularly when the copper-cuprous oxide type such as those now marketed under the names of Rectox and Kuprox, are of the dry type occupying small space, light in weight, and suitable for inclusion in compact arrangement with the elements of an alternating current rectifier-filter system, and suitable for embedding in congealed insulating material with other elements of the socket power unit within a suitable casing.

As indicated the transformer may have an additional secondary 4 which supplies current to the filaments f , f of one or more of the vacuum tubes of the receiving set aforesaid, for example including the filament f of the tube V. The same secondary may supply current to a heater h for an equi-potential cathode k of a detector tube; or for the heater h a separate secondary may be employed.

Or some of the cathodes or cathode heaters may be supplied by rectified filtered alternating current from the source G as indicated in the lower portion of the drawing, where f , f represent filaments of any number of the tubes, and h the heater of an equi-potential cathode k . In this case valve structures V3 and V4, of any of the aforesaid types, particularly the copper-cuprous oxide type, are connected to opposite sides of the line from the source G through inductances L3 and L4 to the point O beyond which again are the choke coils or inductances H, H1 and H2 with the shunted condensers K, K1 and K2 connected to the conductor or bus 5 which in turn is connected to the substantially mid-point 6 of the impedance, preferably an inductance, I, bridged across the supply current connected to the source G. The inductances L3, H, H1 and H2 contribute to the total high inductance and inductive reactance for the valve structure V3 and similarly the inductance L4 and choke coils H, H1 and H2 contribute to the inductance for the valve structure V4 for like purposes. Here again the proportions above described in connection with valve structure V1 and V2 and their associated induc-

tances, apply for like reasons and purposes. Either in advance of the filter system, as at R, or beyond the filter system, as at R1, or in both places, may be inserted resistances for maintaining suitably low the uni-directional voltages impressed upon the terminals of the filaments f and/or heater h . These resistances may be adjustable as shown, or of fixed magnitude, and preferably in any event of such magnitudes as not to vitiate the preferred proportions above referred to, namely high ratio of inductive reactance to resistance of the circuit external to each valve structure.

It will be understood that the filaments f and h of the lower portion of the drawing may be those of any of the vacuum tubes, including V, of the radio receiving set of which V is representative.

Again the valve structures V3 and V4 may be compactly arranged with the other portions of the filter system, and elements thereof may be embedded in congealed insulating material within their container.

What I claim is:

1. Radio receiving apparatus comprising vacuum tube structure of the thermionic type, a source of alternating current, valve structure of the character permitting substantial inverse current for rectifying current from said source for energizing at least one circuit of said vacuum tube structure, and a filter system, the inductive reactance operative in the circuit of the valve structure having a magnitude such that its ratio to the resistance external to the valve structure is high, and the number of valves in series and the impedance of the valve structure being such that the fall of potential across the impedance external to the valve structure is upwards of four times the fall of potential across said valve structure.

2. Radio receiving apparatus comprising vacuum tube structure of the thermionic type, a source of alternating current, valve structure of the character permitting substantial inverse current for rectifying current from said source for energizing at least one circuit of said vacuum tube structure, and a filter system, the inductive reactance operative in the circuit of the valve structure having a magnitude such that its ratio to the resistance external to the valve structure is high, and the number of valves in series being such that the applied alternating current voltage divided by said number is in excess of ten.

3. The method of supplying current for the energization of at least one of the circuits of a vacuum tube of a radio receiving system comprising valve structure including a plurality of units of the type permitting substantial inverse current and a filter having correlated inductance and capacity, which comprises imparting to the circuit of the valve structure inductive reactance which is high with respect to the resistance external to the valve structure and apportioning the number of valve units in series and the impedance of the valve structure such that the fall of potential across the impedance external to the valve structure is upwards of four times the fall of potential across said valve structure.

4. The method of supplying current for the energization of at least one of the circuits of a vacuum tube of a radio receiving system comprising valve structure including a plurality of units of the type permitting substantial inverse current and a filter having correlated inductance and capacity, which comprises imparting to the circuit of the valve structure inductive reactance which is high with respect to the resistance external to the valve structure and limiting the valve units

in series to a number such that the ratio of applied alternating current voltage to said number exceeds ten.

5 5. Radio receiving apparatus comprising vacuum tube structure of the thermionic type, a source of alternating current, valve structures of the character permitting substantial inverse current for respectively rectifying the waves of opposite signs from said alternating current source
10 for energizing at least one circuit of said vacuum tube structure, a filter system including inductance, inductance in series with each of said valve structures and the input end of said filter system, the inductive reactance of the inductance of
15 said filter system and of the inductance individual to each of said valve structures and operative in the circuit of each of said valve structures having a magnitude such that its ratio to the resistance external to each of said valve structures is

high and the number of valves in series and the impedance of each of said valve structures being such that the fall of potential across the impedance external to each valve structure is upwards of four times the fall of potential across each valve structure. 80

6. Radio receiving apparatus comprising vacuum tube structure of the thermionic type, a source of alternating current, valve structure of the character permitting substantial inverse current for rectifying current from said source for energizing at least one circuit of said vacuum tube structure, a filter system to which said circuit of said vacuum tube structure is connected, and inductance, connected in series between said valve structure and an input terminal of said filter system. 85 90

CORNELIUS D. EHRET.

20	95
25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150