


(19)		Canadian Intellectual Property Office	Office de la Propriété Intellectuelle du Canada	(11)	CA 264940	(13)	A
		An Agency of Industry Canada	Un organisme d'industrie Canada	(40)	12.10.1926		
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(12)							
(21)	Application number: 264940D			(51)	Int. Cl:		
(22)	Date of filing: ..						
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(54)	RADIO SYSTEM			(57)	Abstract:		
(54)	SYSTEME DE RADIO						

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My invention relates to radio reception and amplification and pertains specifically to those systems which make use of thermionic tubes of the type utilizing alternating current as the cathode heating agent.

The principal objects contemplated by my invention comprise producing a novel system of apparatus and circuits in which thermionic tubes may be jointly used for reception or amplification and as rectifiers to supply the anode operating potentials necessary for the use of the tubes as receptors or amplifiers, and further to supply a simple and effective device of the above character in which the batteries for both the anode and cathode are entirely eliminated.

I accomplish these and other very desirable features, which will hereinafter be pointed out and discussed, by jointly employing the cathode member of an alternating current tube as a cathode for reception or amplification and as an anode for rectification.

A number of thermionic tubes have been developed and patented which utilize an electron emissive cathode element, which is heated inductively or by direct radiation by a separate heating element, which in turn is heated by an alternating current. These are generally referred to as alternating current tubes. A type of such tube is disclosed in patent No. 234,453, September 25th, 1923, F.S. McCullough. These tubes are all directed to the elimination of the filament or "A" battery and my invention is directed toward utilizing these tubes in a novel circuit and with a novel arrangement of apparatus whereby not only the use of the "A" battery is eliminated but also the need for a "B" battery.

In the drawings which accompany and form a part of this specification:

Fig. 1 illustrates diagrammatically a simple two

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tube radio receiver of the non-regenerative type incorporating my novel system.

Fig. 2 illustrates diagrammatically my novel arrangement as employed for use in a two stage audio amplification circuit.

Referring now particularly to Fig. 1, the tubes 7 and 8 are, as hitherto mentioned, of the alternating current type in which the cathodes 12 and 14 respectively are heated indirectly by filaments 13 and 16 respectively, the only requirement existing is that filaments 13 and 16 be heated to a degree which involves the emission therefrom of an electronic stream. Tube 7 is employed as a detector tube and for this purpose is associated with an antenna coupling inductance 3, the primary of which is connected to antenna 2 and earth 4. A tuning condenser 5 is provided as well as a grid condenser and grid leak 6. One terminal of this input circuit is connected to the grid or control electrode 11 of the tube while the other terminal is connected to the cathode 12 of the tube. The anode 10 of the tube is connected to the primary of an audio transformer 9, the secondary of which is connected at one terminal to the grid 15 of the amplifying tube 8 and the other terminal of the secondary is connected through a battery 42, which acts as a grid biasing battery, to the cathode 14 of the tube. This organization is well known and it is not deemed necessary to explain the functioning thereof. A transformer comprising a primary 30 and secondary windings 27, 28, 29 is provided as the input transformer the primary 30 of which is adapted to be connected to any commercial supply of alternating current. The heating filament 13 of tube 7 is connected to the terminals of secondary 27 through a variable rheostat 19. Likewise the heating filament 16 of tube 8 is connected to the terminals of secondary 28 and provided with a variable rheostat 18.

264940

The secondaries 27 and 28 are of such turn ratio with respect to the primary 31 as to furnish the proper voltage required by the filaments 13 and 16 respectively. The secondary 29 is provided with turn ratio of approximately 2 to 1 with respect to the primary 30 and is utilized as the high tension secondary of a rectifying system and for this purpose one terminal is connected to filament 13 while the other is connected to filament 16. The mid-point of this secondary is connected through inductance 34, resistance 23, variable rheostat 20 with the primary of transformer 9 and through this primary to the anode 10 of the receiving tube 7. Inductance 34 and resistance 23 function as the impedance components of a low frequency filter system. Variable rheostat 20 serves as a means for adjusting the rectified voltage to suit the characteristics of the tubes used. The mid-point of secondary 29 is likewise connected through condenser 25 to both cathode 12 of tube 7 and cathode 14 of tube 8 which thus function as the anodes of the rectifying system. It will be readily observed that conductor 26 connected to the mid-point of 29 and containing inductance 34, resistance 23 and rheostat 20 is the positive terminal of the rectifying system utilizing the filaments 16 and 13 as electron emissive elements in conjunction with the rectifier anodes 12 and 14 and that a rectified current of positive sign will be placed upon the anode 10 of tube 7 and further that a positive potential of higher value will be placed upon the anode 32 through signal receiving device 19 and conductor 31, as conductor 31 is tapped to the positive lead of the rectifier system between resistance 23 and high resistance rheostat 20. The rheostat 20 having a value of approximately 100,000 ohms reduces the potential supplied to the anode 10 of tube 7 to the value necessary

264940

for the proper operation of this tube as a detector, and a higher value of potential is supplied through conductor 31 and signal receiving device 19 to anode 32 for amplification purposes. The condensers 21, 22, 24, 25 are the usual smoothing condensers provided in a filter system as shown.

In the operation of my device alternating current is supplied from secondaries 27 and 28 to heat the filaments 13 and 16 respectively to a degree which causes an electronic emission therefrom. The cathodes 12 and 14 respectively function as anodes with respect to the filaments 13 and 16 and form with the filaments unilinear conductors which operate alternately to apply a rectified current of positive sign through conductor 26, choke coil 34, resistance 23, rheostat 20 and primary of transformer 9, to the anode 10 of tube 7 and through conductor 31 and signal receiving device 19 to anode 32 of tube 8. The heat applied to the anode-cathodes 12 and 14 causes an electron emission therefrom which is directed toward the anodes 10 and 32 due to the rectified positive potentials supplied thereto and thus permits the tubes to be used in the ordinary way as three element receptors or amplifiers.

From the above it will be readily observed that I make use of the tubes 7 and 8 as receptors and amplifiers respectively and that I further make use of these tubes, due to the joint use of the cathodes 12 and 14 respectively, as cathodes for reception and amplification and as anodes for rectification, as rectifiers to supply the proper operating potentials to the anodes for the use of the tubes in detection and amplification. Further by such dual use I have produced a radio reception or amplification system eliminating entirely the need of both "A" and "B" batteries.

Referring now to Fig. 2 in which I have illustrated diagrammatically a multi-step audio amplification system,

264910

tubes 52 and 62 are provided with an input circuit which may be coupled through the audio transformer 50 with any source of audible sounds to be amplified. A grid biasing battery 51 is provided for the grid 53 of tube 52 and the output circuit of tube 52 is connected through audio transformer 59 with the input circuit of tube 62. Grid biasing battery 60 is provided for the grid 63 of tube 62. The anodes 55 and 65 of tubes 52 and 62 respectively are utilized as above described both as cathodes for amplification purposes and as anodes for rectification purposes. They are adapted to be heated by filaments 56 and 66 respectively, which are in turn connected to the secondaries 58 and 68 respectively of the input transformer, the primary 70 of which is connected to any commercial source of alternating current. The rheostats 57 and 68 are provided to adjust the voltage supplied the filaments 56 and 66 respectively. A high tension secondary 70 is provided, the extremities of which are connected to the filaments 56 and 66 respectively and the mid-point of which is connected through inductance 73, resistance 74, high resistance rheostat 75, and the primary of the coupling transformer 59, to the anode 54 of tube 52 and further through conductor 67, signal receiving device 64 to the anode 61 of tube 62. The mid-point of secondary 70 is connected to the cathodes 55 and 65 as shown. Smoothing condensers 76, 77, 78 and 72 are provided and connected as shown to eliminate any ripple. It will be observed that the inductance 73, resistance 74 and adjustable rheostat 75 together with the smoothing condensers 76, 77, 78 and 72 constitute a low frequency filter system which may be considered as being inserted between the output of the rectifying organization and the anodes 54 and 61 of the condensers 52 and 62 respectively. The rheostat 75 serves as a means to vary the voltage

in accordance with the demands of tubes of variant types. This organization just described obviously functions both as a multi-step audio amplifying system and further as a rectifying and filter system for supplying the anode potentials required by the tubes for amplification purposes.

It will be observed from the foregoing that I have produced a simple and effective means for dual utilization of an alternating current thermionic tube in a system of radio reception or amplification and for rectification; that such a system requires neither "A" or "B" battery and is simple and effective.

While I have illustrated and described but one embodiment of my device I wish it to be clearly understood that I may vary the details thereof without departing from the spirit or narrowing the scope of my invention.

Having thus described my invention, what I claim as new and desire to secure by Canadian Letters Patent is as follows:-

1. In a radio communication system, a plurality of alternating current tubes, a transformer for supplying filament current therefor, an additional winding on said transformer and associated with said tubes to form a rectifying system and a filter system associated with said rectifying system and through which rectified current is supplied to the anodes of said tubes.
2. In a radio communication system, a plurality of thermionic tubes each provided with an anode, a control electrode and a plurality of members adapted to be heated, operating circuits associated with the anodes, control electrodes, and one of the heated electrodes of each of said tubes to permit said tubes to function as receivers and amplifiers, and operating connections with both of the heated members of each of said tubes to permit said tubes to function as rectifiers of alternating current.
3. In a radio communication system, a plurality of thermionic tubes each provided with an anode, a control electrode and a plurality of members adapted to be heated, operating circuits associated with the anodes, control electrodes, and one of the heated electrodes of each of said tubes to permit said tubes to function as receivers and amplifiers, operating connections with both of the heated members of each of said tubes to permit said tubes to function as rectifiers of alternating current and a filter system associated with said rectifying system.
4. In a radio communication system, a plurality of thermionic tubes each provided with an anode, a control electrode and a plurality of members adapted to be heated, operating circuits associated with the anodes, control electrodes, and one of the heated electrodes of each of said tubes to permit said tubes to function as receivers

and amplifiers, operating connections with both of the heated members of each of said tubes to permit said tubes to function as rectifiers of alternating current and a filter system interposed between the output of said rectifying system and the anodes of said tubes.

5. In a radio reception and amplification system, a plurality of thermionic tubes each provided with an anode, a control electrode and a plurality of heated electrodes and means for utilizing the anodes, control electrodes, and one of the heated electrodes of each of said tubes for the reception and amplification of high frequency carrier waves, and further, means provided for utilizing both of said heated electrodes of each of said tubes as rectifiers of alternating current.

6. In a radio reception and amplification system, a plurality of thermionic tubes each provided with an anode, a control electrode and a plurality of heated electrodes, means for utilizing the anodes, control electrodes and one of the heated electrodes of each of said tubes for the reception and amplification of high frequency carrier waves, and further, means provided for utilizing both of said heated electrodes of each of said tubes as rectifiers of alternating current and a filter system interposed between the output of said rectifying system and the anodes of said tubes.

7. In a radio reception and amplification system, a plurality of thermionic tubes each provided with an anode, a control electrode and a plurality of heated electrodes, means co-acting with the anodes, control electrodes and one of the heated electrodes of each of said tubes to utilize said tubes for reception and amplification, and further, means for utilizing both of the heated electrodes of each of said tubes as a rectifier of alternating current.

264949

8. In a radio communication system, a plurality of thermionic tubes each provided with an anode, a control electrode, a cathode and an element to heat said cathode, a transformer adapted to provide a supply of current of proper voltage for said heating elements, connections with said transformer and the heating elements and heated electrodes of said tubes whereby said tubes operate as rectifiers, a filter system and means associating the output of said filter system with the anodes and cathodes of said tubes whereby said tubes may be utilized as receptors and amplifiers.

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