Sept. 21, 1937. N. E. LINDENBLAD 2,093,683

THERMIONIC TUBE AND CIRCUIT

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Fig. 1

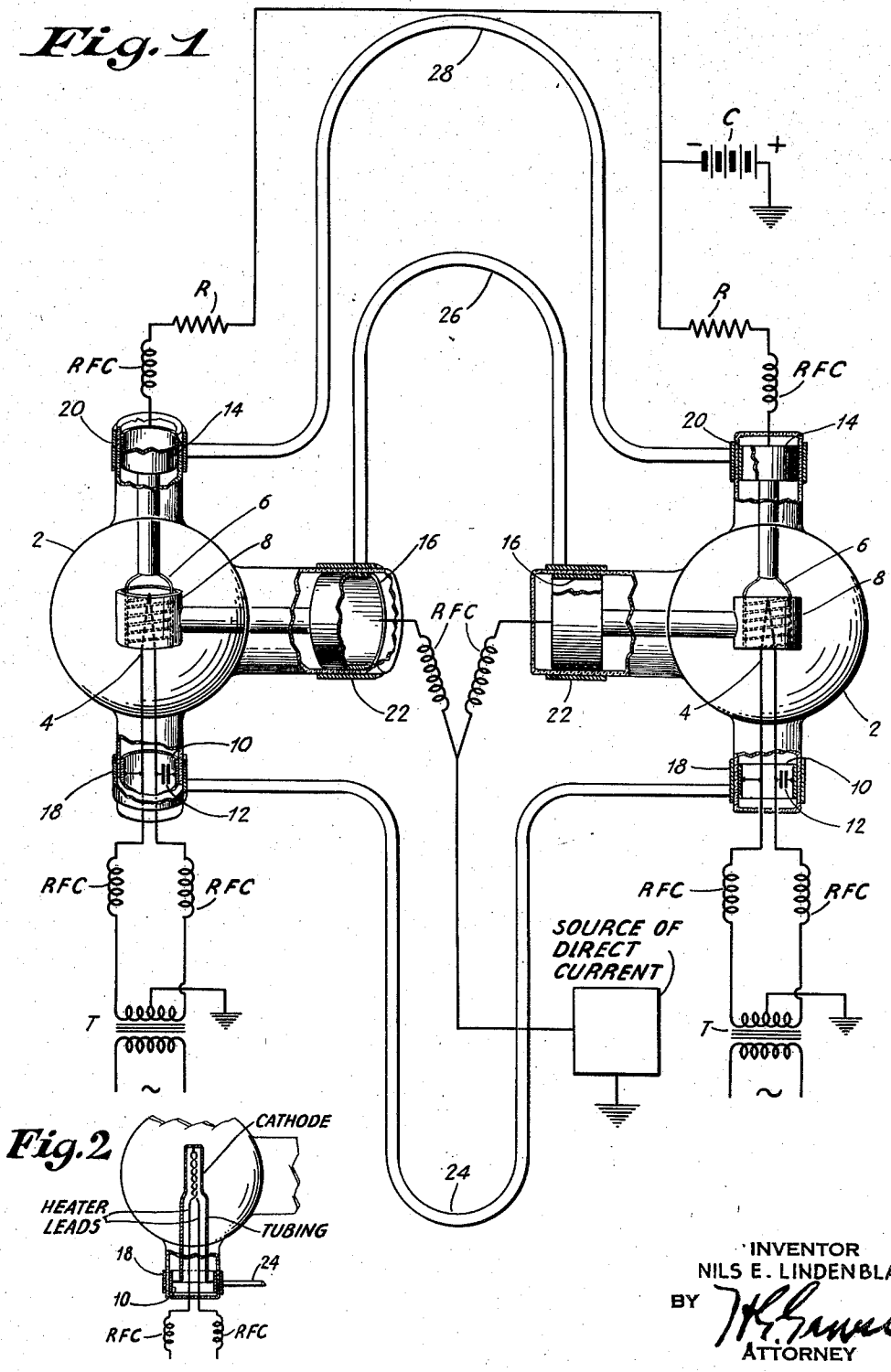


Fig. 2

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THERMIONIC TUBE AND CIRCUIT

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6 Claims. (Cl. 250—36)

This invention relates to a new thermionic tube and to said novel tube in connection with circuits particularly adapted to derive from said novel tube optimum operation.

It is well known that the higher the frequency becomes the lower the capacitive reactance between the elements in a vacuum tube subject to said high frequency becomes. Accordingly, the intensity of the high frequency oscillating currents will become higher and higher as the frequency of oscillation increases in order to maintain the proper oscillating voltage necessary between electrodes for the functioning of the tube. For ordinary short wave needs, this trouble may to a certain extent be remedied by making the leads or conductors connected with the tube elements of large cross-section area to accommodate the increased current. For still shorter waves, it becomes increasingly difficult to increase the dimensions of these conductors or leads any further because of the cumbersome glass seals required for such heavy leads. To overcome this defect, I propose to make it possible to obtain the radio frequency connection between the tube elements and the external circuits by means of a capacitive coupling. This permits me to use small conductors leading from elements in the tube through the vitreous envelope, to supply to said elements the necessary direct current potentials, keeping in mind that current of small intensity is usually sufficient for operation.

In disclosing the invention, for purposes of illustration I have shown a novel circuit arrangement particularly applicable to the tube of the invention. However, I do not intend to limit this disclosure to the use of such a circuit with my novel tube, since obviously the tube of the present invention is applicable to practically any use known in the radio art. The tube of my invention is particularly adapted to short radio frequency waves. The tube may be used in ultra-high frequency relay circuits in which oscillations are relayed, amplified, relayed and amplified, frequency multiplied, amplified and frequency multiplied, etc. The tube is particularly adapted to use in circuits for producing ultra-high frequency waves.

In further describing my invention, reference will be made to the drawing, in which:

Fig. 1 shows diagrammatically a tube, the electrodes of which are arranged in accordance with my invention. The electrodes of the tubes in Fig. 1 are also connected in novel alternating current circuits and direct current supply circuits.

Fig. 2 shows a modification of the electron emission electrode structure of the tube of Fig. 1.

Referring to the drawing, each thermionic tube may comprise an envelope 2 enclosing a thermionic system including an emission electrode 4, a control electrode 6 and an anode electrode 8. The vitreous envelope 2 may have a main body in which said thermionic system is located and from which elongated portions extend. Each of the electrodes 4, 6 and 8 are connected with conducting members which extend out to different elongated portions of the tube. The emission electrode 4 is connected by leads extending through the vitreous envelope of the tube to a transformer T which may be connected to a source of energizing current. One side of the filament energizing circuit is connected directly to a conductive member 10 located within the envelope. The other side of the filament heating circuit is connected by a condenser 12, of low impedance to high frequency waves, to said member 10. The anode and control grid electrodes are in a similar manner connected by heavy conducting members to large surface conductors 14 and 16, respectively, located in extended portions of the envelope. In order to apply the necessary biasing potential to the control grid 14, I pass a small conductor from the enlarged metallic portion 14 through the tube envelope and connect this lead by way of a radio frequency choke RFC and biasing resistance R to a source C and to ground. In order to supply the necessary charging potentials to the anode electrode 8, a conductive lead is passed from the member 16 through the tube envelope and by way of a radio frequency choke RFC to a direct current source and to ground. Since, as shown in the drawing, the large conducting portions and the members 14 and 16 extend away from the control grids 6 and 8, respectively, the internal capacity between the electrodes is not materially increased by my novel tube structure.

In order to connect the electrodes of the tube disclosed in an alternating current circuit, I provide sleeve members 18, 20 and 22, respectively, located on the outer periphery of each tube envelope adjacent the conducting members 10, 14 and 16, respectively. The three external sleeve members are then connected in alternating current circuits 24, 26 and 28, respectively, as shown, the circuits being completed by way of the capacities formed between the elements 10 and 18, 14 and 20, and 16 and 22, respectively. The capacity reactance between the elements 10, 18; 14, 20 and 16, 22 may be maintained sufficiently low to have negligible radio frequency voltage drops. The

alternating current circuits 24, 26 and 28 may be utilized as above to amplify, multiply or produce alternating current potentials.

In some cases, it may be preferable to use a thermionic tube of the cathode heater type. This permits the emission element to be conveniently extended in the opposite direction from the grid electrode element. This emission element may take the form of a sleeve and may also carry the heavy high frequency current which at times falls upon the filament of the directly heater or indirectly heated tube. Such a structure has been illustrated in Fig. 2, wherein the cathode is heated indirectly by a heater element connected by leads to a source of heating current. The emission element may be connected to a sleeve in turn connected directly to an enlarged member 10 coupled to 18.

What is claimed is:

1. In a discharge tube, a container having a sleeve-like portion for each electrode of the thermionic system and a main portion from which said sleeve-like portions extend, an electron system having a plurality of electrodes arranged in said main portion, conductors extending from each electrode of said system to a different one of said sleeve-like portions, conducting members of appreciable area connected to each of said conductors, each of said conducting members being located within the inner periphery of its respective sleeve-like portion, and conducting members located on the outer periphery of each of said sleeve-like portions.

2. In a discharge tube, a container having a sleeve-like portion for each electrode of the thermionic system and a main portion from which said sleeve-like portions extend, an electron system including a plurality of electrodes arranged in said main portion, conductors extending from each electrode of said system to a different one of said sleeve-like portions, a conducting member of appreciable surface connected to each of said conductors, said conducting members each being located within the inner periphery of its respective sleeve-like portion, and conducting members located on the outer periphery of each of said sleeve-like portions whereby alternating current circuits may be coupled between the electrodes of said tube by way of the coupling between the conducting members on the inner and outer peripheries of said cylindrical portions.

3. In a discharge tube system, a container having a main portion and an extended portion for each electrode of the thermionic system, an electrode system of the multi-electrode type arranged in said main portion, conductors extending from each electrode of said system to a different one of said extended portions, an enlarged sleeve member connected to each conductor and located within the inner periphery of the respective extended portions, conducting members located on the outer periphery of each of said extended portions, and alternating current circuits coupled between said outer conducting members.

4. In a discharge tube system, a container having a main body and an extended portion for each electrode of the thermionic system, a multi-electrode system arranged in said main body, conductors extending from each electrode of said system to a different one of said extended portions, an enlarged member connected to each conductor and located within the inner periphery of the respective extended portions, a lead passing from each enlarged member through the envelope of said container, sleeve-like members located on the outer periphery of each of said portions, alternating current circuits coupled between said outer sleeve-like members, and direct current circuits connected between the leads passing through the envelope of the container.

5. In a discharge tube system, a container having a cylindrical portion for each electrode of the thermionic system and a main portion, a multi-electrode system arranged in said main portion, conductors extending from each electrode of said system to a different one of said cylindrical portions, an enlarged cylindrical sleeve connected to each conductor and located within the inner periphery of the cylindrical portions, a lead passing from each cylindrical sleeve member through the envelope of said container, cylindrical sleeve-like members located on the outer periphery of each of said cylindrical portions, alternating current circuits coupled between said outer sleeve-like members, and direct current circuits connected with the conductors passing through the container.

6. In an ultra high frequency signalling system, a plurality of electron discharge devices each comprising a container enclosing an anode, a cathode and a control grid electrode, a conducting member of considerable area connected to each electrode in each device and located adjacent the inner wall of the container of said device, corresponding conductive members of considerable area located adjacent the outer wall of the container of each of said devices and coupled to said first named members, there being a conducting member adjacent the outer wall of the container of each device for each conducting member adjacent the inner wall of the container of each device and reactances connecting corresponding conducting members adjacent the outer walls of the containers of said devices together to thereby couple corresponding electrodes of said devices in ultra high frequency circuits.

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