A Direct Current Power Supply Based on Electron Emission

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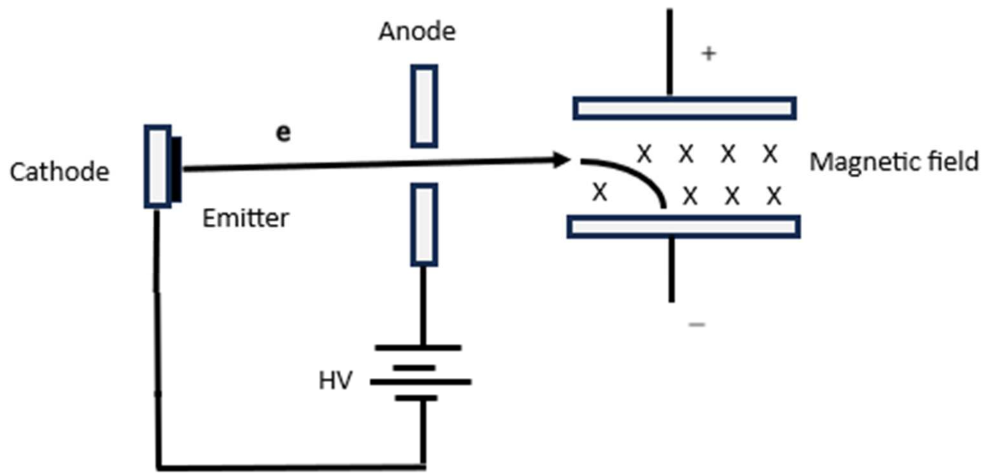
Abstract

A direct current power supply was designed based on electron emission. An anode is used to accelerate electrons toward a parallel plate capacitor, which is connected to the positive and negative terminals of a battery. A permanent magnetic field acts on the capacitor, causing the electrons to bend toward the negative plate of the capacitor. The output current consists of the electrons reaching the negative plate.

Description:

A direct current (DC) power supply consists of a cathode, an electron emitter, an anode, a parallel plate capacitor, and a magnetic field. The electron emitter is a thermionic emitter. A conducting filament is used to heat the thermionic emitter. A high positive voltage (HV) is connected to the anode so that electrons can be accelerated toward the anode. Focusing electrodes can be used to focus the electron beam. The anode has a hole through which electrons can pass to the capacitor. Figure 1 shows that the capacitor plates are connected to the positive and negative terminals of a battery respectively. There is a built-in electric field between the plates. A magnetic field acts perpendicular to both the electron beam and the electric field inside the capacitor, causing the electrons to bend toward the negative plate if the

Lorenz force is greater than the electric force. The electrons reaching the negative plate will charge the battery as a DC source.



The input power includes the power consumed by the emitter and the power consumed by the anode. The electron binding energy of metals is usually around 4.0 eV. Since the thermal efficiency is about 20%, it costs about 20 eV to emit one electron. The anode dissipates power only when the electrons hit the anode. If the electrons do not hit the anode, the power dissipated by the anode is zero. Focusing electrodes can be used to focus the electron beam so that few electrons hit the anode. It is reasonable to expect that less than 10% of electrons will hit the anode. When electrons enter the capacitor along its midline, they bend toward the negative plate in the direction of the electric field between the plates so that they lose the kinetic energy gained from the anode. Ideally, the electrons reach the negative plate before losing all kinetic energy. For example, the anode potential is 5000 V, and the capacitor plates connect to potential of +5000 V and -5000 V respectively. If the current flowing out of the emitter is 1.0 A, the current hit the anode is 0.1 A. The power consumed by the emitter is 20 Watts. The power consumed by the anode is 500 Watts. The output potential is -5000 V. The output current is 0.9 A. The output power is the product of current and the potential, which is 4500 Watts. In this case, the output power is much greater than the input power.