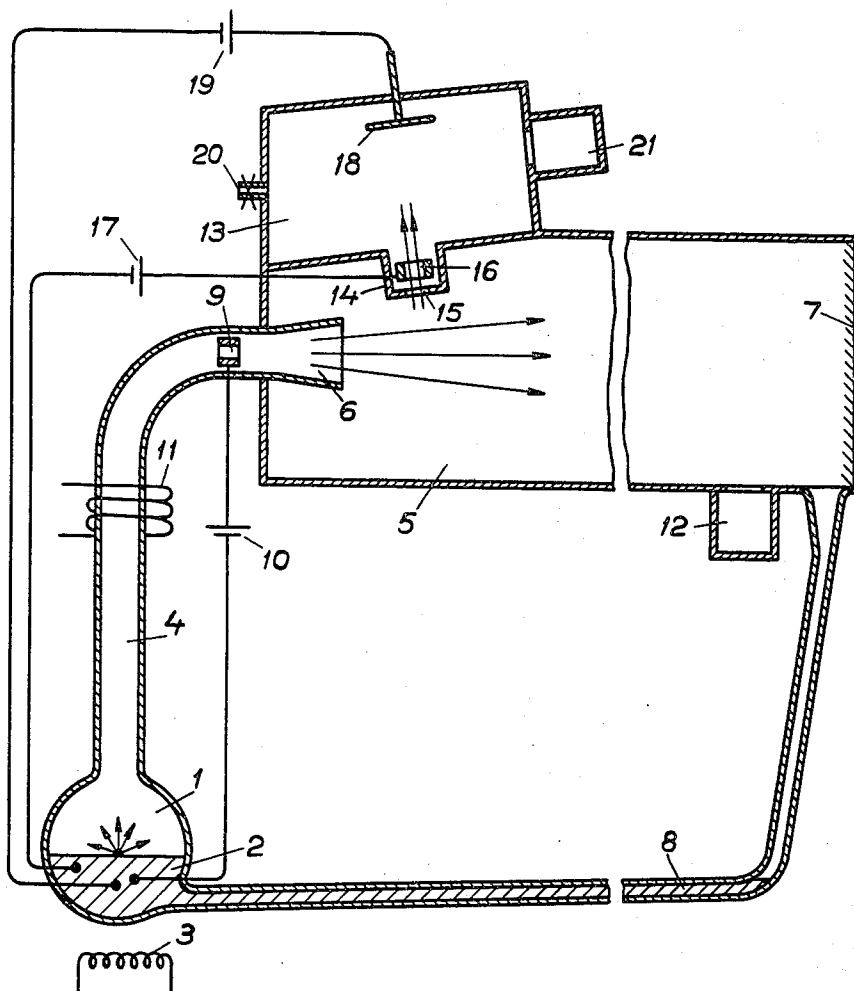


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ELECTRON BEAM GENERATOR INCLUDING A PLASMA
BEAM IN A CONDENSING CHAMBER
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ELECTRON BEAM GENERATOR INCLUDING A PLASMA BEAM IN A CONDENSING CHAMBER

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ABSTRACT OF THE DISCLOSURE

A device for generating an electron beam includes means for generating a plasma beam in a condensing chamber. At the side of condensing chamber is an electron chamber having an annular anode and a catch anode. A source of voltage is connected between a plasma emitting cathode and the two anodes. The direction of the voltage between said two anodes is substantially perpendicular to the direction of the plasma beam.

In many different technical fields there is a great demand for devices, which can emit large amounts of electrons, corresponding to current intensities of hundreds of amperes, without simultaneous emission of neutral atoms and ions. The only electronic emitters known at present, that is those emitters which do not simultaneously emit neutral atoms and ions, are for example different types of directly heated cathodes, cold cathodes and devices for field emission. From these devices, however, only a limited current of a size of some tens of amperes can be obtained.

The present invention relates to a device by means of which it is possible to generate a continuous electronic current of a size which considerably exceeds what has been possible previously. The characteristics of the invention are evident from the following description.

A description of a possible embodiment of the invention as it is shown in the enclosed drawing is given in the following.

A cathode vessel 1 contains mercury 2 which constitutes the cathode material of the device. The mercury can be heated by means of a heating coil 3. The vapor generated by the heating is led through a tube 4 into a condensing chamber 5 electrically insulated from the cathode vessel in which chamber the tube ends with a nozzle 6. In the condensing chamber at least the wall 7 of the condensing chamber opposite the nozzle is cooled, so that the flowing Hg-vapor is condensed and runs back into the cathode vessel through a condenser tube 8. It is also possible to have all the walls cooled. Due to the large amount of vapor generation in the cathode vessel and resulting high pressure of the Hg-vapor as well as the low pressure which is kept in the condensing chamber, a vapor beam from the nozzle is projected with a very high speed into the condensing chamber. The low pressure is maintained by means of a vacuum pump 12.

In order to ionize the gas which flows from the cathode vessel through the tube into the condensing chamber an annular auxiliary anode 9 is inserted in the tube and connected to a voltage source 10 which is also connected to the Hg-cathode. The voltage drop between the auxiliary anode and the cathode makes the gas in the tube ionize and a plasma stream is obtained which has a high speed when leaving the nozzle 6. The ionization can be increased further by an ionization coil 11 arranged around the tube 4 which coil is fed with a high frequency current. By means of these ionization devices a very strong plasma stream in the condensing chamber 5 is obtained.

An electron chamber 13 is arranged at the end of the

condensing chamber where the nozzle ends. The chamber has a bulge 14 having a wall which is mainly parallel to the direction of the plasma stream and in this wall an opening 15 is made. Inside the bulge there is an annular anode 16, which is connected with the cathode over a voltage source 17. In the extension of the symmetrical axis of the annular anode there is a catch or extractor anode 18 which is connected with the cathode. In this connection a voltage source 19 can be included, if it is found suitable.

The voltage drop between the annular anode 16 and the cathode causes an electron stream from the Hg-cathode through the tube 4 and the annular anode 16 to the anode 18. The plasma stream has such a high speed when passing the opening 15 that ions and neutral gas atoms continue straight forward, while the electrons due to their negative charge are sucked into the annular anode by the electric field and a pure electron stream is obtained in the electron chamber 13.

In a variation of the invention the annular anode is not used, and instead the voltage generating the electron stream is placed between the catch anode 18 and the cathode. It is of course possible to combine these two variations.

The electron chamber is provided with a gas inlet 20 and a vacuum pump 21. It is thereby possible to insert any suitable gas in the vacuum chamber. The density of this gas must, however, not be so large that the gas which is forced down through the opening 15 in the accelerating plasma causes too many collisions with cathode material atoms, so that these are spread upwards and into the electron chamber. The plasma which flows to the right also works as a diffusion pump for the gas which is forced down from the electron chamber, whereby a certain amount of gas is obtained at the condensing wall 7. This gas is taken away by means of the vacuum pump 12.

In time it is impossible to avoid a certain amount of vapor of cathode material being forced into the electron chamber. In order to prevent this vapor from condensing on the inner surfaces, these are kept at such a high temperature that the vapor pressure of the vapor at this temperature is higher than the real vapor pressure of the vapor due to the flux through the opening 15. It can furthermore be necessary to continuously pump away so much vapor by means of the vacuum pump 21 that a sufficiently low vapor pressure can be maintained. If another gas is used in the electron chamber, the vacuum pump will pump out this gas and therefore there is always a certain consumption in such cases.

The necessary gas current for obtaining the plasma stream can also be taken from a tank containing a suitable gas under high pressure. The gas stream is ionized by means of a gas discharge between said auxiliary anode 9 and an electronic emitter connected thereto across a voltage source. This emitter is preferably arranged in the vicinity of the gas generating device and can consist of a cathode of mercury known per se or other metal, for example cesium, where the electrons are emitted from the cathode spot. It is also possible to use other devices for generation of a stream of gas or stream.

The catch anode 18 can also be placed outside the electron chamber 13, so that the whole space of the chamber is available for examinations and experiments. This is especially suitable if the electron stream is to be used in a gas with a pressure which is too high for use in the electron chamber. For this purpose an opening which does not let gas through is arranged partly between the condensing chamber and the electron chamber and partly between the electron chamber and the catch anode.

We claim:

1. A device for generating a continuous electronic cur-

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rent between an anode and a cathode, comprising means for generating a gaseous stream with a high speed, means in the path of such gaseous stream for ionizing said stream to a plasma stream, an anode arranged at the side of the plasma stream positioned to extract electrons therefrom, and a cathode connected to said anode, the gaseous stream generating means comprising a cathode vessel containing an electron emitting metal and provided with a heating device, said metal constituting the cathode, a condensing chamber, a tube connecting the cathode vessel to the condensing chamber, the tube ending in the condensing chamber in a nozzle, means for cooling at least the wall of the condensing chamber opposite the nozzle, and a return tube for condensed metal leading from the condensing chamber to the cathode vessel.

2. A device according to claim 1, the tube leading from the cathode vessel to the condensing chamber being provided with ionizing means including an annular auxiliary anode.

3. A device according to claim 1, the tube leading from the cathode vessel to the condensing chamber being provided with ionizing means including a device for high frequency ionization of the gaseous stream.

4. A device according to claim 1, an electron extracting chamber arranged laterally with respect to the plasma stream in the condensing chamber.

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5. A device according to claim 4, the anode comprising an annular anode arranged in the electron extracting chamber.

6. A device according to claim 4, having a catch anode arranged inside the electron extracting chamber and connected to the cathode.

7. A device according to claim 6, a voltage source in the connection between said catch anode and the cathode.

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