ION PRODUCING MECHANISM

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This invention relates to ion generators and more particularly to ion generators of the type employing electron bombardment of a solid body to be ionized.

It is an object of the invention to provide a simple and efficient ion generator.

Another object of the invention is to provide an ion generator wherein electrons bombard a solid body to produce ions of the material comprising the body.

Other objects and advantages of the invention will be apparent from the following description and claims considered together with the drawings forming an integral part of this specification and comprising an isometric view of apparatus embodying my invention.

Referring now to the drawing it will be seen that an evacuated vessel is formed by means of a glass cylinder 1 capped on the bottom by a metallic plate 2 and on the top by a metallic plate 3. Appropriate seals are provided to render the vessel air-tight and a pump line 4 is connected to a pump 5 to evacuate the vessel to any desired degree.

Positioned on the bottom plate 2 is a tripod 1 made of tungsten upon which is placed a crucible 8 of high temperature insulator, such as alundum. Placed within the crucible is a block of material 9 from which ions are desired; for example, a block of uranium metal has been utilized in this connection. A tungsten wire 11 is secured to the block 8 and passes through an insulating bushing 12 in the bottom plate 2 to provide an anode lead for the block 9.

Positioned near the top of the vacuum vessel is a coiled filament 13 having two legs 14 passing through the upper cover 3 through insulating bushings 16. A grid 17 is mechanically supported by the filament 13 and is maintained at filament potential, and fits completely across the upper interior of the glass cylinder 1.

The filament 13 is rendered thermally emissive by a battery 18 placed across the two filament legs 14, the resistive current heating the filament 13 to a white heat whereupon it emits electrons. The filament 13 is made the cathode of a circuit the block 9 is made the anode of a circuit by a battery 19 connected to one of the legs 14 and to the anode lead 11. The upper cover 3 is rendered negative with respect to the filament 13 and the supported grid 17 by a battery 21 connected between one leg 14 and the cover 3. An ammeter 22 is placed in the circuit to determine the currents reaching the plate 3.

In operation, the battery 18 passes current through the filament 13 rendering it thermally emissive, the electrons forming a stream 23 which strikes the block 9, the anode of the circuit. The impingement of the electrons upon the block 9 creates heat which vaporizes the block 9, causing the vapor to fill the vacuum vessel. This vapor in turn is bombarded by the electron stream 23, setting up an arc discharge. This arc discharge gives rise to an arc plasma which fills the entire vacuum vessel below the grid 17 and takes on the potential of the most positive member with which it is in contact, namely, the block 9. The grid 17 is therefore negative with respect to the arc plasma and attracts toward it positive ions from the arc plasma. These ions pass through the grid 17 and encounter the negative field of the top plate 3. They are therefore accelerated toward this plate 3, causing a current to flow through the ammeter 22, which current is a measure of the number of ions removed from the arc plasma.

The mechanism just described has been successfully employed in generating ions of uranium. This general structure, therefore, could be used in a calutron or other device wherein ions of uranium or any other metal are desired. Further, it is of general utility as a ion generator or for any other purpose in which ions are desired.

Although I have described my invention with respect to a specific embodiment thereof, it is not limited to this embodiment nor otherwise except by the terms of the following claims.

What is claimed is:

1. A device for producing ions comprising a vacuum envelope, an anode therein made of material to be ionized, an electron emissive cathode that supplies electrons for the bombardment of the material, a grid at cathode potential extending across the vacuum envelope in the region of the cathode, an electrode in the vessel disposed on the opposite side of the grid with respect to the cathode, a current reading meter connected to the electrode, and means for applying potential to the electrode that is negative with respect to the grid.

2. An ion source including a cathode, an anode comprising a material to be vaporized, means establishing an arc discharge from said cathode to said anode for vaporizing and ionizing a portion of said material, and means for withdrawing from the region of said material at least a portion of said ions.

3. An ion producing mechanism comprising an electron emissive cathode, an anode formed of a material to be ionized and maintained at a posi-
tive potential with respect to said cathode whereby an arc discharge is established therebetween and said anode is ionized, a grid electrode disposed on the opposite side of said cathode from said anode and maintained at substantially the same potential as said cathode whereby ions forming the arc plasma are attracted thereto, and an electrode disposed on the opposite side of said grid from said cathode and maintained at a negative potential with respect to said grid whereby ions attracted to said grid are further attracted therethrough and toward said electrode.

4. Ion producing mechanism comprising an evacuated envelope, a filamentary electron emissive cathode, an anode comprising a solid mass of the material to be ionized and disposed at a distance from said cathode, said anode and cathode being disposed internal to said envelope, power supply means maintaining said anode at a positive potential with respect to said cathode whereby electron discharge is established between said cathode and anode thereby vaporizing the material of said anode, said electron discharge ionizing said vaporized anode material to produce an arc discharge having an arc plasma including posi-

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