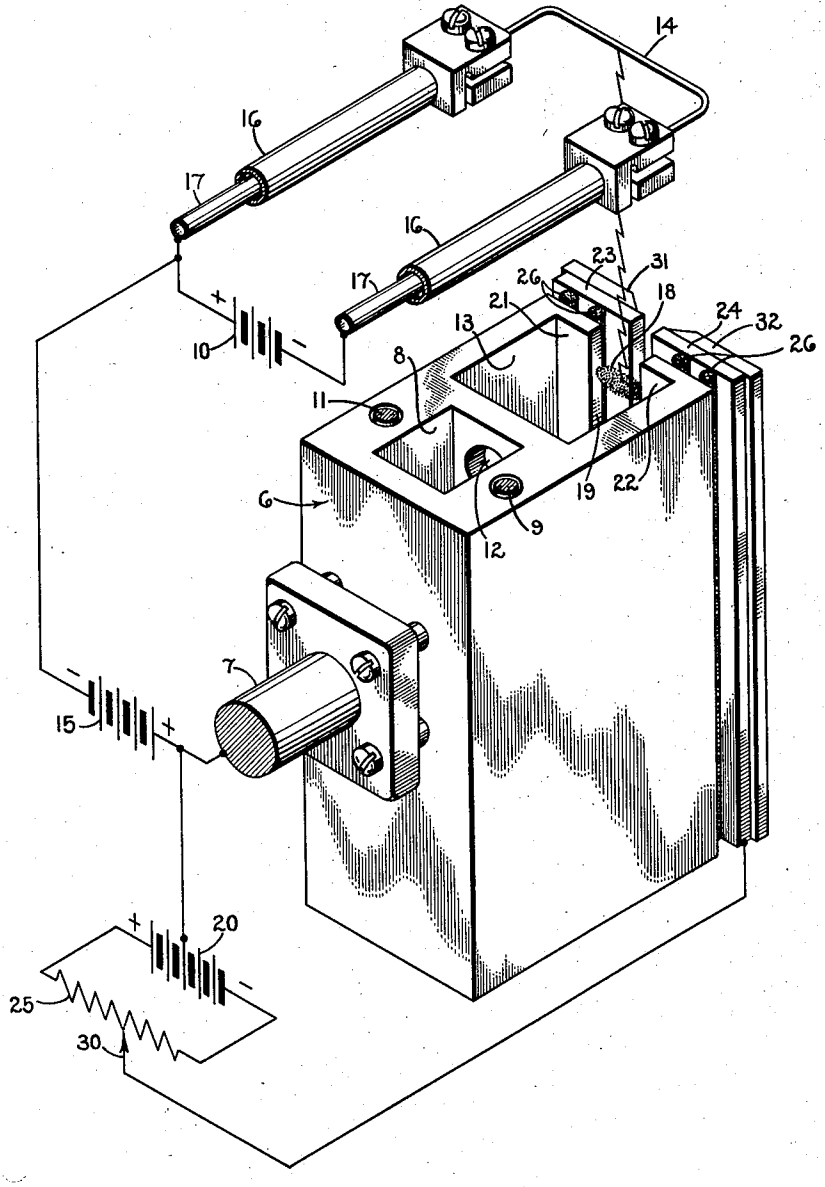
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DUAL HEATED ION SOURCE STRUCTURE HAVING ARC SHIFTING MEANS

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DUAL HEATED ION SOURCE STRUCTURE HAVING ARC SHIFTING MEANS

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This invention relates to ion sources for calutrons and more particularly to an electrode arrangement for the ion generator of a calutron ion source.

Calutrons are described generally in "Atomic Energy for Military Purposes" by H. D. Smyth, and are described in greater detail in my prior U.S. Patent No. 2,709,222, which issued on May 24, 1955. Calutrons are employed for the separation of isotopes, and have been chiefly and very successfully employed in separating the isotopes of uranium for military energy purposes. In general, ions are formed in an ion generator and are projected into a magnetic field by an intense electric field. The paths of travel through the magnetic field are generally curved, the ions of heavier mass defining a flatter curve than those of lighter mass. Appropriate collectors are disposed across the paths of the different isotopes, such as the 180° point, to neutralize and collect the various isotopes substantially separated from isotopes of different mass.

The ion source with which this invention is concerned includes an electric arc as an ionizing mechanism and the arc plasma is exposed to the aforementioned electric field and ions are withdrawn from this plasma. The present invention relates to shaping and otherwise affecting the surface of this arc plasma that is exposed to the electric field. This is done in accordance with the present invention by having the ion exit from the ion generator defined by two coplanar plates that are electrically insulated from the chamber in which the main body of the arc is situated and providing means for applying various potentials to these plates relative to the arc enclosing member.

It is therefore an object of the invention to provide a calutron ion generator having its ion exit defined by plates insulated from the arc confining member.

Another object of the invention is to provide insulated arc plates for an ion generator and means to apply various potentials to these plates.

Other objects and advantages of the invention will be apparent in the following description and claims taken in conjunction with the accompanying drawing which is a schematic illustration of an arc block, electron emissive filament and insulated arc slit defining plates of a calutron ion generator.

For a complete and detailed showing and description of the various accompanying mechanisms not immediately pertinent to the present disclosure, reference is again had to the mentioned patent of Lawrence, inasmuch as the showing herein is almost entirely of a diagrammatic or schematic nature.

The structure includes an ion source block 6, preferably fabricated of a good thermal conductor, such as copper, mounted on a supporting stem 7 also serving as an electrical conductor. The block 6 is provided with a normally covered interior charge cavity 8 for the reception of material to be ionized. This material is usually introduced into the cavity 8 in an open charge container and is customarily of a solid form, for example in granules. To supply the heat requisite for vaporizing the

charge material, the arc block 6 is equipped with a plurality of electric heaters 9 and 11, effective when energized to gassify or vaporize the charge material contained within the cavity 8. The resulting gas or vapor flows from the cavity 8 through a connecting passageway 12, into a normally covered distribution and arc chamber 13, likewise formed in the copper block 6.

Disposed in a suitable location spaced from the block 6 is a filamentary cathode 14, supported at the ends of a pair of support and conducting rods 16 and 17, respectively, connected in a suitable electric supply, such as a battery 10, to energize the filament 14 and also connected to a supply 15 having its other end connected with the block 6, so that the block, itself, serves as an anode and so that an arc is struck between the filament and the block 6, the pattern of the arc being represented by the stippled portion 18 of the drawing.

Ions formed by the interaction of the arc and of the flowing gas are withdrawn from the chamber 13 through an exit opening 19, defined by facing walls 21 and 22 of the block 6. Additionally, the exit opening 19, sometimes referred to as an arc slit, is further defined by a pair of coplanar fastening plates 23 and 24, preferably formed of a heat resisting material such as molybdenum, that are relatively closely approached to define the narrowest portion of the opening 19.

Since it is desired to insulate the plates 23 and 24 from the ion source block 6, porcelain rods 26, preferably a pair at each side of the opening 19, are interposed between the molybdenum plates 23 and 24 and the copper walls 21 and 22, and suitable insulated fastening means secure the plates to the block 6. Means to apply varying potentials to the plates 23 and 24 is provided by a power supply illustrated as a battery 20 having a mid-point connected to the battery 15 and, therefore, also to the supporting stem 7 and its attached ion source block 6. A resistor 25 connects the two ends of the battery 20 and a variable take-off 30 slides on the resistor 25 and is connected to both of the plates 23 and 24, the connection to plate 24 only being shown. The take-off 30 may be manually operated to apply the same potential or varying positive and negative potentials to the plates 23 and 24 relative to the ion source block 6.

It is well known that the arc plasma will assume the potential of the most positive member with which it is in contact. Therefore, when the plates 23 and 24 are positive, the arc plasma will "attach" itself to the arc slit plates 23 and 24 and the arc plasma surface from which the ions are withdrawn will be stretched between the opening between the plates. If the plates are made negative, the arc plasma will then attach itself to the ion source block 6 and stretch between the walls of opening 19. Thus, means are provided not only to move the arc plasma surface inwardly and outwardly but by varying the amounts of the different positive or negative potentials, various shapes of this surface may be assumed because of the influence of the electric field.

While this invention has been described with reference to a particular embodiment thereof, it is not limited to this embodiment nor otherwise except by the terms of the following claims.

What is claimed is:

1. In a calutron, means for generating a beam of ions with reduced electrode wear therefrom and comprising in combination, an ion source member including a heated arc chamber having an exit opening, thermally conducting plates defining the margins of said opening, said plates being adapted to serve as electrodes for shaping said beam and having electrical connections thereto, and means electrically insulating said plates from said member.

2. In a calutron, means for generating a beam of ions with reduced electrode wear therefrom and comprising in

combination, an ion source member including an arc chamber having an exit opening, means for heating said source member, thermally conducting plates defining margins of said exit opening, said plates being adapted to serve as electrodes for shaping said beam and having electrical connections thereto, and means for electrically insulating said plates from said member.

3. In a calutron, means for generating a beam of ions with reduced electrode wear therefrom and comprising in combination, an ion source member including an arc chamber having an exit opening, electrically conducting plates defining the margins of said opening, said plates being adapted to serve as electrodes for shaping said beam and having electrical connections thereto, and means electrically insulating said plates from said member.

4. In a calutron, means for generating a beam of ions with reduced electrode wear therefrom and comprising in combination, an ion source member including an arc chamber having an exit opening, electrically conducting plates defining the margins of said opening, means electrically insulating said plates from said member, and means for applying a potential to said plates different from the potential of said member.

5. In a calutron, means for generating a beam of ions with reduced electrode wear therefrom and comprising in combination, an ion source member including an arc chamber having an exit opening, electrically conducting plates defining the margins of said opening, means electrically insulating said plates from said member, and means for applying various potentials to said plates relative to said member and varying from negative to positive.

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