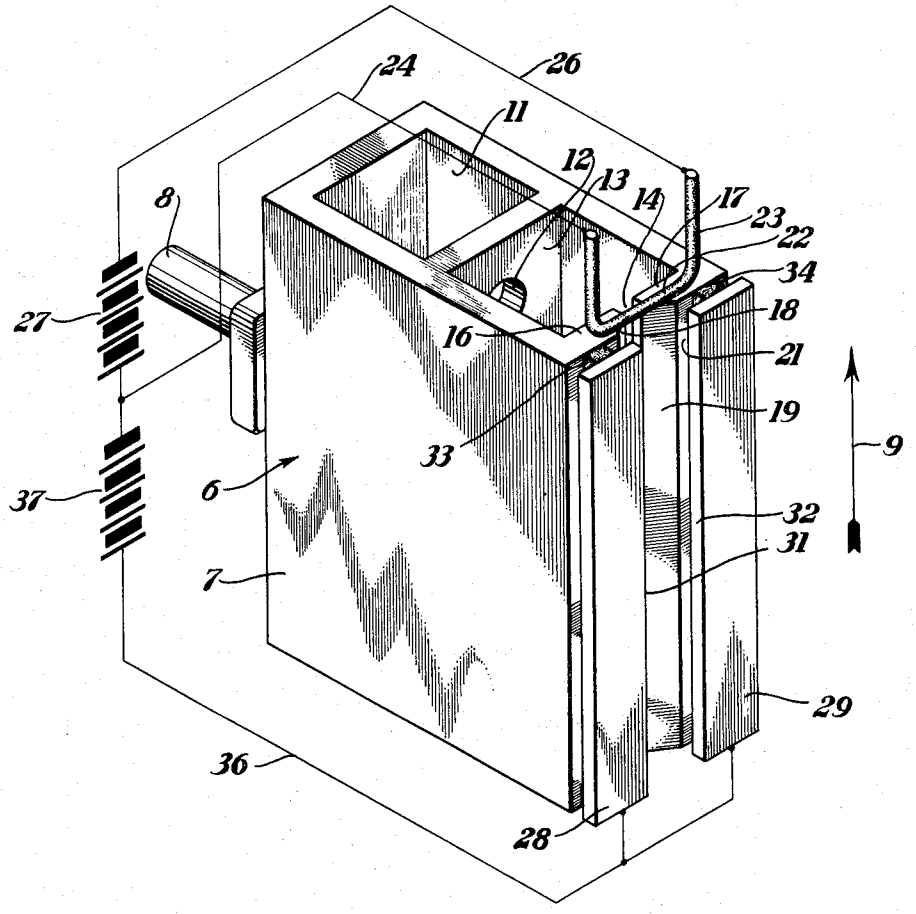
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CALUTRON ION SOURCE

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CALUTRON ION SOURCE

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5 Claims. (Cl. 250—41.9)

The present invention relates to ion producing mechanisms, and especially to mechanisms effective to ionize material in a vapor or gaseous form by the agency of an electric arc established in a magnetic field between a filament, serving as a cathode, and an appropriate anode or anodes. A structure of this general type is referred to as a "calutron," and is disclosed extensively in United States Patent No. 2,709,222, issued May 24, 1955, to Ernest O. Lawrence. In the Lawrence patent, there is disclosed in Figures 3 to 5, particularly, an embodiment of the invention to which the present disclosure is especially applicable. Because of the detailed disclosure in the Lawrence patent, the showing herein is primarily in diagrammatic form, and all parts which are not immediately germane to the present invention are omitted from the present description and showing.

In the operation of an ionizing mechanism of the type referred to, it is desirable to produce as uniform an electric arc as possible and to maintain the arc operating uniformly over an extended period of time, in order to produce as copious a supply of ions as may be. In addition it is desired that the ions, after formation, be withdrawn in a uniform and regular manner, for example in the shape of a ribbon-like beam, from the ion forming mechanism. In order to produce a relatively large supply of ions, a relatively long arc is employed, and it is an advantage to have the arc as uniform as possible throughout its entire length. Additionally, the electric field existing adjacent to the arc is of great effect in establishing and controlling the initial paths of efflux of the generated ions, so that a favorable field contour is desirable.

It is, therefore, an object of the invention to provide an improved arc mechanism for forming ions.

An additional object of the invention is to provide a means for establishing and mantaining a uniform, elongated arc.

An additional object of the invention is to provide an arc mechanism also productive of favorable electric fields in the arc vicinity.

A still further object of the invention is to provide an arc mechanism capable of protracted, uniform operation.

An additional object of the invention is in general to improve the structure and operation of ionizing mechanisms, and more particularly of calutrons.

Other objects, together with the foregoing, are attained in the embodiment of the invention illustrated in the accompanying drawing, in which the figure is a schematic or diagrammatic showing, in isometric perspective, of a structure embodying the invention, virtually all mechanisms not immediately pertinent to the present invention being omitted.

The present invention is embodied in connection with an ion producing mechanism, generally designated **6**, including an ion source block **7**, preferably fabricated of a conducting material such as the metal copper, supported in an appropriate location in the calutron environment upon a mounting stem **8**. The orientation of the source block **7** is such that its larger dimensions are parallel to

the direction of the ambient magnetic field. The field direction is illustrated in the drawing by an arrow **9**.

Included in the block **7** is a normally covered charge cavity **11**, within which the material to be ionized is placed and from whence gas or vapor discharges through an aperture **12** into a normally covered gas distribution chamber **13**, likewise defined by the walls of the block **7**. The gas to be ionized is discharged or released from the cavity **13** through an exit opening **14** of elongated form extending substantially parallel to the direction **9**, and being defined by facing walls **16** and **17** included in the block **7**. Preferably, the walls **16** and **17** are, along the margins of the opening or slit **14**, divergently beveled to provide dihedral faces **18** and **19** leading to an arc chamber generally designated **21**.

Disposed above the arc chamber **21**, in registry with the opening **14** and in alignment in the direction **9** of the field, is the emitting portion **22** of a filamentary cathode **23**. Conductors **24** and **26** connect the filament to a source **27** of power to heat the filament to electron emitting incandescence.

To cooperate with the cathode **23** for the production of a satisfactory and improved arc, there are provided in accordance with the invention a pair of coplanar, electrically conducting plate **28** and **29**, respectively, arranged with their length substantially parallel to the direction **9** of the magnetic field and with their facing edges **31** and **32** additionally defining an extension of the arc slit opening **14**. The plates **28** and **29** are electrically insulated from the arc block **7**, although they are mechanically supported thereon, by means of interposed electrical insulating strips **33** and **34**. With this arrangement, there is defined a suitable arc chamber having its exit edges established by longitudinally extending plates, electrically isolated from the block **7**.

In order that the plates **28** and **29** can serve as appropriate anodes, they are connected electrically together by a conductor **36**, extending to a suitable source **37** of electrical power effective to establish a voltage difference between the cathode **23** and the anode plates **28** and **29**, so that an arc discharge occurs for substantially the entire length of the arc cavity **21**. The arc does not immediately proceed from the cathode to the anodes by a short path, due to the collimating, or restricting, or confining influence of the ambient magnetic field on the electrons emitted from the filament. Rather, the arc extends in the direction of the magnetic field along and between the plates **28** and **29**. Since these plates have uniform edges near the arc they do not disturb the electric field, but leave it in a favorable condition.

The result of the described structure is to provide a relatively uniform, elongated arc in the path of gas issuing through the opening **14**, so that there is a large proportion of ionized material released from the ion generator. There is, in accordance with the invention, provided an improved ion generator having an ac operating uniformly over a protracted period of time, and maintaining itself with great uniformity throughout its entire length. Consequently, the operation of the calutron over a long period with a copious output of ions is assured.

What is claimed is:

1. A calutron comprising an ion source member including an arc chamber having an exit opening, a cathode disposed to discharge electrons into said arc chamber, means forming electrodes defining the margins of said exit opening, means for insulating said electrodes from said member, and means for electrically connecting said electrodes to serve as anodes for said cathode.

2. A calutron for use in a magnetic field having a predetermined direction comprising an ion source member including an arc chamber having an exit opening, a cathode disposed to discharge electrons into said arc chamber,

electrodes extending in the direction of said field disposed at either side of said exit opening, and means for including said cathode and said electrodes in an electric arc circuit.

3. A calutron comprising an electrically conducting ion source member including an arc chamber having an exit opening, a cathode arranged to discharge electrons into said arc chamber, an electrode adjacent said exit opening, means for insulating said electrode from said ion source member, and means for including said electrode and said cathode in an arc discharge circuit.

4. A calutron for use in a magnetic field having a predetermined direction comprising an electrically conducting ion source member including an arc chamber having an exit opening elongated in said direction, a cathode disposed to discharge electrons into said arc chamber,

electrodes extending in said direction and defining the margins of said exit opening, means for electrically insulating said electrodes from said member, and means for including said cathode and said electrodes in an electric arc circuit.

5. A calutron for use in a magnetic field having a predetermined direction comprising an ion source member including an arc chamber having an exit opening elongated in said direction, a cathode disposed in registry with said opening in the direction of said field, electrodes disposed at either side of said opening and elongated in the direction of said field, and means for including said cathode and said electrodes in an electric arc circuit.

No references cited.