BIMETALLIC FILAMENT POSITIONING DEVICE

Inventor:
William E. Glenn Jr.

By John P. Deffit
His Attorney.
This invention relates to an electrical element positioning device and particularly to an electrically controlled filament centering device for electron discharge devices and the like.

It is frequently desirable to physically alter the position of a filament or other electrode inside an electron discharge device from outside the device. For example, in cathode ray tubes employing small hairpin filament for generating extremely small diameter electron beams, it is frequently necessary to provide mechanical adjustment externally operated in order to adjust the centering of the emitting end of the filament. While the results of mechanical adjustment linkages of this type are satisfactory, the mechanism involved is expensive and cumbersome and moreover does not lend itself to automatic or remote control centering.

It is therefore an object of the present invention to provide a simple and economical means for centering and positioning filaments or other electrodes electrically or from a point remote from the electrodes.

Briefly stated in accordance with an aspect of the present invention, the filament or electrode device is physically supported by means of curvilinear bimetallic means which carry current to the electrode. By adjusting the current flow through the bimetallic means, its temperature may be altered and therefore its physical configuration.

In accordance with one embodiment of the present invention, an electron discharge device filament including two support leads is further supported by two pairs of curvilinear bimetallic members, disposed substantially orthogonally to one another. A first pair carries the filament current to one of the filament support leads while a second pair carries the filament current to the second filament support lead. The proportion of the filament current carried by each bimetallic member of a pair is remotely adjustable with a potentiometer so that a temperature differential exists between the bimetallic strips connected to one of the support leads. The bimetallic members carrying a larger current tends to distort the most and acts to cause movement of the filament in a predetermined direction.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. The invention, however, both as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings wherein like reference characters refer to like elements and in which:

**FIG. 1** is a perspective view of an embodiment of the present invention, and

**FIG. 2** is a plan view of an embodiment of the present invention further including circuitry for its operation.

Referring to the drawing, a filament or element to be position controlled, is provided with two support conductors 2 and 3 which are parallel to one another and held in spaced relation by brace members 4 and 5. Support member 2 is joined to two curvilinear support conductors 6 and 7 positioned approximately in line with support conductors 2 and 3. The bimetallic members 6 and 7 are conveniently formed of a strip of steel at their outside radius riveted or otherwise joined to a strip of brass or copper at their inside radius. The bimetallic members are attached to conducting posts 8 and 9, arranged substantially in line with the support conductors 2 and 3 on either side of the filament and extended through an insulating base 10 to provide externally accessible terminals 11.

A second pair of curvilinear current-temperature sensitive or bimetallic members 11 and 12 are joined to the support conductor 3, this support conductor being foreshortened to allow bimetallic members 11 and 12 to be attached thereto while passing over bimetallic member 7. Bimetallic members 11 and 12 are joined respectively to conducting posts 13 and 14, also embedded in common insulating base 10 on either side of the filament. Conducting posts 13 and 14 as well as bimetallic members 11 and 12 in general form a configuration substantially orthogonal to that of bimetallic members 6 and 7 and their respective conducting posts 8 and 9.

Member 10 is part of an envelope of an electron discharge type device, for example, of the cathode ray beam type, wherein it is desirable to position the electron beam 19 produced by filament 1 and accelerated through an aperture focusing electrode indicated at 20. Filament 1 is centered with respect to electrode aperture 20 in order to control electrically the position of filament 1, the current is varied through the bimetallic members.

Referring particularly to **FIG. 2**, a first potentiometer 15 is coupled between conducting posts 8 and 9 and is provided with a slidable contact 16 operable to control the filament movement. Similarly, the potentiometer 17 having slidable contact 18 is disposed between conducting posts 13 and 14. Slidable contacts 16 and 18 are conveniently coupled to a source of filament power 19.

In operation the device according to the present invention, provides for the remote electrical centering or positioning of the filament electrodes. Positioning of slidable contacts 16 and 18 on potentiometers 15 and 17 act to adjust the proportion of filament current flowing in the bimetallic members which current acts to energize the filament 1 to an electron emitting temperature. The slidable contact 16 when moved towards the end of potentiometer 15 closest conducting post 9, causes a larger proportion of the filament current to flow through bimetallic member 7 than bimetallic member 6. Under such circumstances, bimetallic member 7 becomes heated and becomes more heated than bimetallic member 6, since the brass strip 7 is on the outside radius of the bimetallic member, the bimetallic member 7 will bend or curl more than bimetallic member 6. Member 6, carrying less current, bends less. This causes support conductor 2 to move generally in the direction X in **FIG. 2**, that is towards conducting post 9, the same direction in which slidable contact 16 was moved. Likewise, movement of slidable contact 16 in direction W will cause support conductor 2 to move in direction W, designated in **FIG. 2**.

Similarly movement of slidable contact 18 of potentiometer 17 in the direction Y will cause movement of support conductor 3 in the Y direction, and movement of slidable contact 18 in the direction W causes movement of support conductor 3 in the W direction. Of course, since the filament together with its support conductors and brace members is a unitary device, movement of one of the support conductors will have the same directional effect upon the positioning of the filament electrode. For example, movement of support conductor 2 in the direction X by movement of slide contact 16 in that direction will move the whole filament assembly in that direction and will also cause movement of bimetallic members 11 and 12 in the same direction. Since this is in a direction substantially orthogonal to the general configuration of bimetallic members 11 and 12, no undue strain is imparted to members 11 and 12. Also movement of the electrode structure by bending of the bimetallic members 11 and 12, and movement of the filament assembly is provided in the X direction, and thus the filament is moved in a plane essentially in the X and Y directions.

In operation, changing the proportion of filament current flowing in the bimetallic members will cause movement of the filament. The effect of this movement is amplified by the mechanical lever arm of the filament conductors and further amplified by the mechanical lever arm of the bimetallic members and conducting posts. As each filament conductor is moved, the bimetallic members 6 and 7, or members 11 and 12, will move with respect to the cathode ray beam envelope, and this will cause a change in filament shape. The filament shape is thus controlled remotely through the current proportioning potentiometer setup.
3. In a Y direction has a limited mechanical effect upon bimetallic members 6 and 7. The electrode structure tends to turn or hinge at support conductor 2.

While illustrated primarily with respect to the physical positioning of a filament electrode, it is apparent the present invention in its broader aspects is applicable to other electrode elements and the like to provide effective remote positioning thereof electrically, and, for example, from outside the evacuated electron discharge device.

While I have shown and described several embodiments of my invention, it will be apparent to those skilled in the art that many changes and modifications may be made without departing from my invention in its broader aspects; and I therefore intend the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an electron discharge device, an apparatus for positioning the filament thereof comprising first and second terminals for said filament, a first pair of posts electrically conductive disposed on either side of said filament, a pair of curvilinear bimetallic strips extending one from each of said first pair of posts and joined in common to the first terminal of said filament to mechanically support said first terminal while carrying current thereto, a second pair of electrically conductive posts disposed in a line substantially perpendicular to a line between said first pair of posts, a second pair of curvilinear bimetallic elements extending one from each of said second pair of posts and joined to the second terminal of said filament to support said filament and carry current thereto, a first potentiometer means connected between said first pair of posts and including a first adjustable tap, a second potentiometer means extending between said second pair of posts and including a second adjustable tap, and means providing a current between said first and second adjustable taps flowing proportionately through said potentiometers and through said posts to energize said filament.

2. In an electron discharge device, an apparatus for centering the filament thereof comprising first and second terminals for said filament, a first pair of conductive posts disposed on either side of said filament, a pair of curvilinear bimetallic strips extending one from each of said first pair of posts and joined in common to the first terminal of said filament to mechanically support said first terminal and carry current thereto, a second pair of conductive posts also disposed on either side of said filament and between said first pair of posts in a line substantially perpendicular to a line between said first pair of posts, a second pair of curvilinear bimetallic elements extending one from each of said second pair of posts and joined to the second terminal of said filament to support said filament and carry current thereto, a first potentiometer means connected between said first pair of posts and including a first adjustable tap, a second potentiometer means extending between said second pair of posts and including a second adjustable tap, and means providing a current between said first and second adjustable taps flowing proportionately through said potentiometers and through said posts to energize said filament.

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GEORGE N. WESTBY, Primary Examiner.