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TEMPERATURE REGULATING TUBE SHIELD

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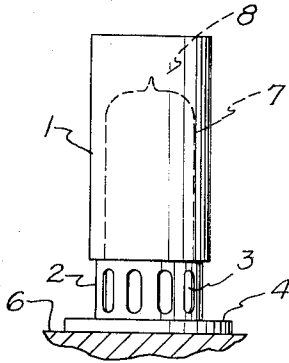


Fig. 1

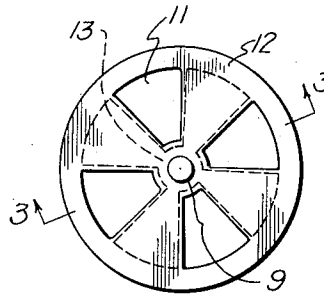


Fig. 2

Fig. 3

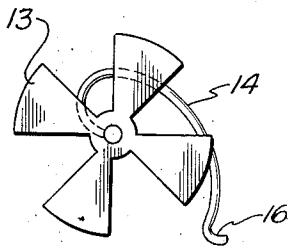
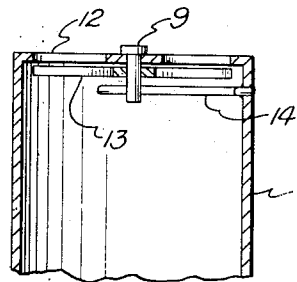


Fig. 4

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TEMPERATURE REGULATING TUBE SHIELD

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6 Claims. (Cl. 257—2)

This invention is concerned with the temperature regulation of space discharge devices and more particularly is directed to a novel type radiation shield for maintaining a constant temperature in gas conduction electron tubes.

It has long been known in the art that the performance of certain electron tubes, such as voltage regulators and thyratrons, is dependent upon the ambient temperature of the surroundings. Ambient temperature variations produce undesirable variations in the characteristics of the tubes.

The present invention provides a relatively simple means for tube temperature control incorporated into a novel tube radiation shield. The improvement consists of a special type of tube shield provided with a bimetallic or other temperature-sensitive means for controlling the natural convection flow of air in the space between the tube and the shield.

One object of the present invention is to provide a novel radiation shield for electron tubes.

Another object of the present invention is to provide a shield for heat generating devices having temperature control means incorporated therein.

Still another object is to provide means for controlling the temperature of electron tubes.

A still further object of the present invention is the provision of an electron tube shield having means for automatically controlling the operating temperature of an electron tube.

Another object is the provision of a tube shield having means for automatically maintaining constant the operating temperature of an electron tube.

Other uses and advantages of the invention will become apparent upon reference to the specification and drawings, in which:

Fig. 1 is a front view of the tube shield of the present invention;

Fig. 2 is a top view of the tube shield of Fig. 1;

Fig. 3 is a partial cross section taken along lines 3—3 of Fig. 2; and

Fig. 4 is an enlarged view of the shutter and temperature-sensitive spring arrangement shown in Figs. 2 and 3.

Referring to the drawings, in Fig. 1 is shown a front view of a tube shield or can 1 employing the novel features of the present invention. The shield 1 includes a lower portion or base 2 having a plurality of ventilating apertures 3. As shown, shield 1 may rest on a conventional tube socket generally indicated at 4, which in turn may be affixed to a breadboard or other suitable member 6. Supported in socket 4 is a standard type gas conduction tube 7 indicated in dotted lines in Fig. 1. Shield 1 may be maintained about tube 7 by any of the conventional holding means such as clasps or spring elements. Such holding elements are not shown and form no part of the present invention.

As can be seen in Fig. 1, the electron tube 7 shown by dotted lines does not occupy the entire interior volume of the cylindrical shield 1. Rather the relative size of the

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shield is chosen so that the shield is slightly larger than the tube about which it is placed. The result is that a space such as is shown at 8 is left at the upper portion of the shield. This space 8 is utilized to house a portion of the temperature control apparatus which forms the principal feature of the present invention.

In Fig. 2 is shown a top view of a tube shield of Fig. 1. The top portion or cover 12 of shield or can 1 includes a plurality of upper ventilating apertures 11. Indicated by dotted lines at 13 is a rotatable shutter including blade-like elements adapted to be rotated about a pivot 9 to close off the flow of air through apertures 11. As shown in Fig. 2, shutter 13 is in an open position so that a maximum amount of air may flow out through the top of the shield 1. A slight rotation of shutter element 13 begins to close off the apertures 11 and thus reduce the amount of flowing air which may escape through the top of the shield. Further rotation of shutters 13 will completely close off apertures 11 and allow no air to escape through the top portion 12 of shield 1.

Fig. 3 is a partial cross-sectional view of shield 1 taken along a line 3—3 of Fig. 2. Pivot 9 is in the form of a pin or rivet which passes through the top portion 12 of shield 1 and is affixed at its lower end to a temperature-sensitive spring element 14. Shutter 13 is secured to pivot 9 and rotates therewith. The temperature responsive element 14 comprises a motor or driving source which provides rotary motion for the pin and shutter assembly.

A better understanding of the operation of spring element 14 in conjunction with shutter 13 can be had with reference to Fig. 4. Spring element 14 may be in the form of a curved bimetallic rod. A variation in temperature will vary the mechanical position of bi-metallic spring element 14 in a well-known manner to impart rotation to shutter 13. Spring 14 includes a turned-over end portion 16 which is adapted to fit through a small slot in the wall of shield 1. The end 16 of spring 14 may be securely attached to the wall of shield 1 by means of soldering or brazing so that a firm support for the entire unit is provided from the wall of the shield.

The temperature-regulating tube shield of the present invention is so designed that when it is placed around a tube generating heat, a substantial part of the cooling of said tube will be by convection or by "stack effect" caused by movement of air between the inner surface of the shield and the outer surface of the tube. Provision is made for this flow of air by way of apertures 3 and 11 in the lower and upper portions respectively of the shield. Due to the lower density of hot air it tends to rise, removing heat as it flows. The regulation of this flow by the means described is used to vary the amount of heat removed from the tube in such a manner as to keep the temperature of the tube relatively constant despite variations in ambient temperature and variations in amount of heat generated by the tube. By suitable variation in the design features of shutter 13 and temperature-sensitive element 14 the constant temperature provided by the instant invention can be varied within wide limits. The invention is not limited to the particular shutter element employed or its position since a shutter may be employed to control the flow through apertures 3 in place of or in addition to the control of flow through apertures 11 shown in the drawing.

It will be apparent that the embodiment shown is only exemplary and that various modifications can be made in construction and arrangement within the scope of invention as defined in the appended claims.

What is claimed is:

1. In combination with an electron tube mounted in a tube socket a temperature-regulating tube shield comprising a radiation shield can adapted to completely en-

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close said electron tube, said can having convection air current inlet and outlet apertures, shutter means in said can for selectively closing said outlet aperture, and temperature-sensitive means connected to said shutter means for moving said shutter means in such a direction as to oppose temperature variations within said can.

2. In combination with a thermionic gas discharge device a temperature-regulating tube shield comprising an elongated hollow can member adapted to fit over said thermionic gas discharge device, the lower portion of said can member including at least one ventilating aperture, at least one additional ventilating aperture included in the upper portion of said can member, and means responsive to the temperature within said can member for varying the size of one of said apertures.

3. In a can for shielding thermionic devices from electromagnetic radiation the improvement comprising the incorporation of ventilating apertures in the lower and upper portions of said can for the flow of convection air currents through said can and thermosensitive means responsive to the temperature within said can for regulating the amount of said flow.

4. In combination with a thermionic gas discharge device a temperature-regulating tube shield comprising an elongated hollow tubular member closed at one end and adapted to fit over said thermionic gas discharge device, said member having at least one aperture at said closed end and at least one additional aperture adjacent the other end thereof, shutter means for selectively closing one of said apertures and means responsive to the temperature within said tubular member for varying the position of said shutter means in accordance with the variations of said temperature.

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5. In combination with a thermionic gas discharge device a temperature-regulating tube shield comprising a radiation shield can adapted to completely enclose said thermionic gas discharge device, said can having a first plurality of apertures in its top and a second plurality of apertures about its lower circumference whereby a convection air current is permitted to pass through said can by way of said apertures, shutter means for selectively closing said first apertures, and bimetallic spring means sensitive to variations in the temperature within said can for moving said shutter means in such a direction as to counteract said variations.

6. In combination with an electron tube a temperature-regulating tube shield comprising a radiation shield can for completely enclosing said electron tube, said can having at least one lower convection air current inlet aperture and at least one upper convection air current outlet aperture, a shutter in said can adjacent said outlet aperture, and a bimetallic spring supported in said can and connected to said shutter, said spring being responsive to temperature variations within said can to move said shutter in such a direction as to modify the effective area of said outlet aperture in opposition to said variations.

References Cited in the file of this patent

UNITED STATES PATENTS

1,460,820	Mertznanoff	July 3, 1923
1,977,494	Shapard	Oct. 16, 1934
2,690,899	Clay	Oct. 5, 1954
2,732,418	Lindley	Jan. 24, 1956
2,745,895	Lideen	May 15, 1956