Jan. 24, 1956 F. A. LINDLEY, JR 2,732,418

TUBE SHIELD

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Fig. 1.

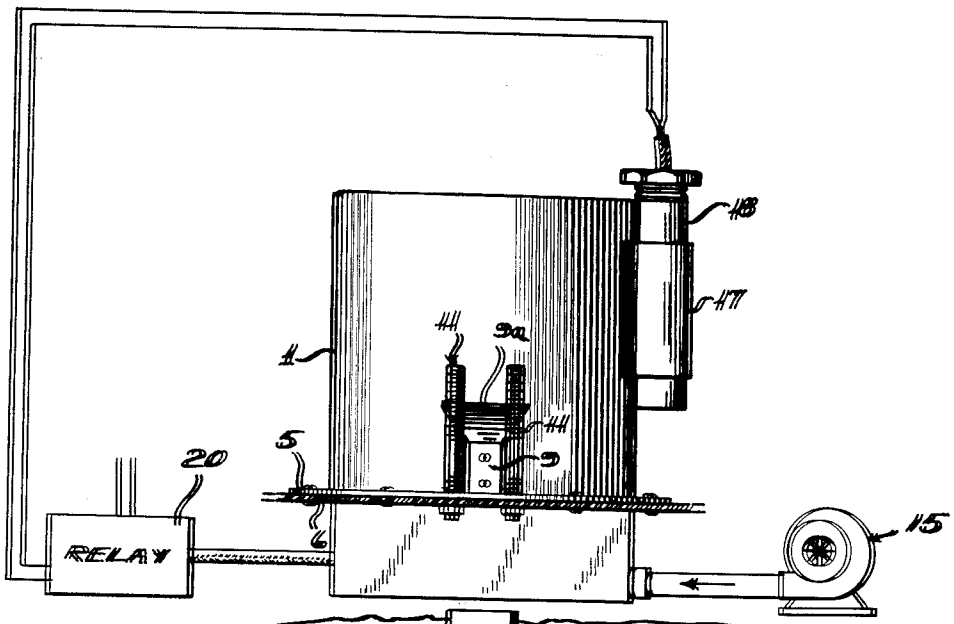
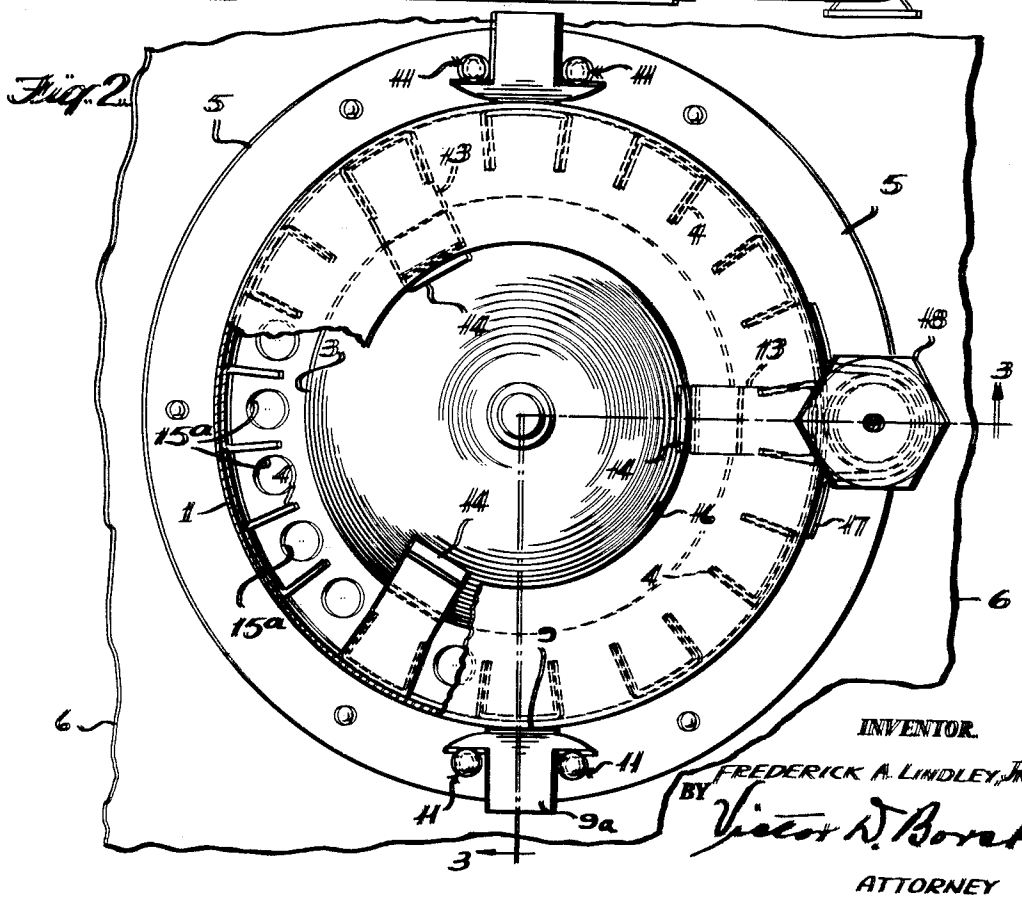


Fig. 2.



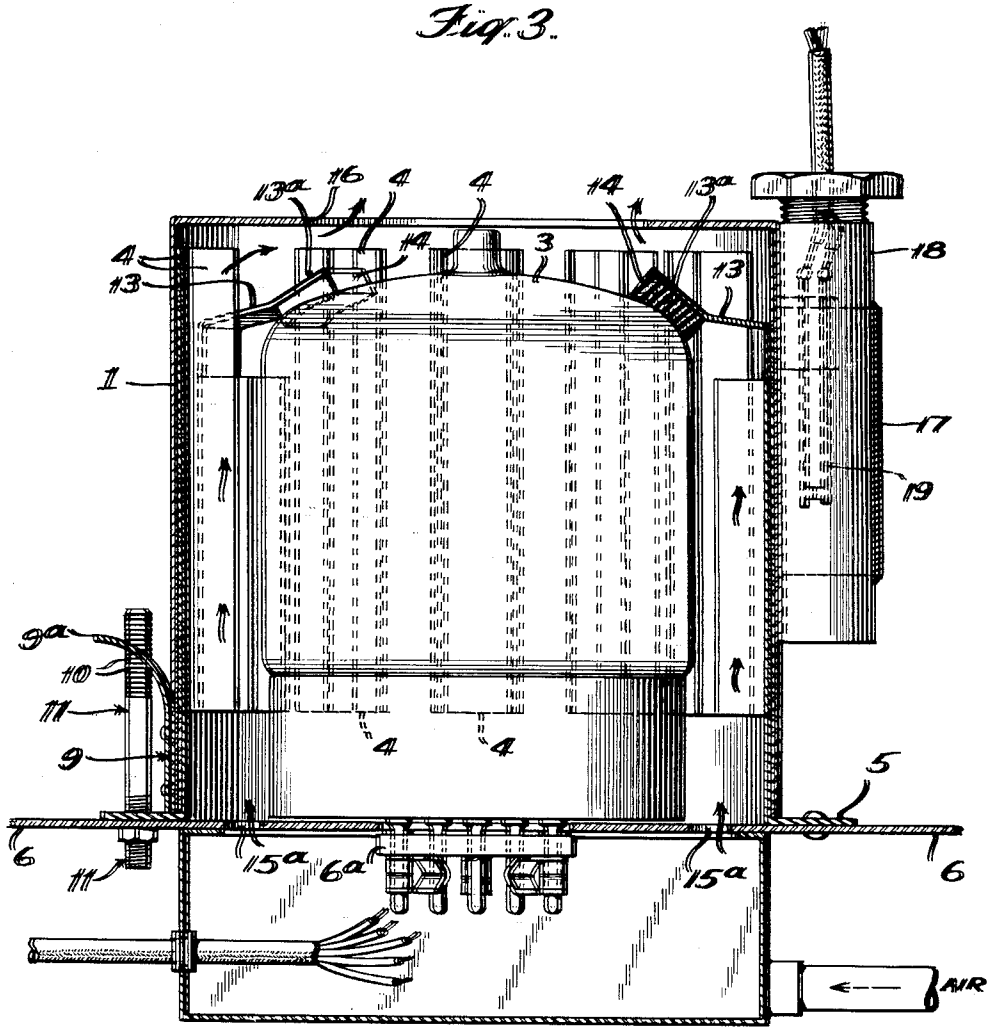
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Fig. 3.



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Fig. 4.

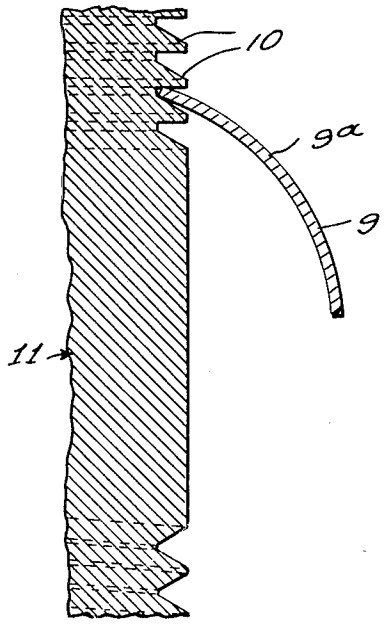


Fig. 5.

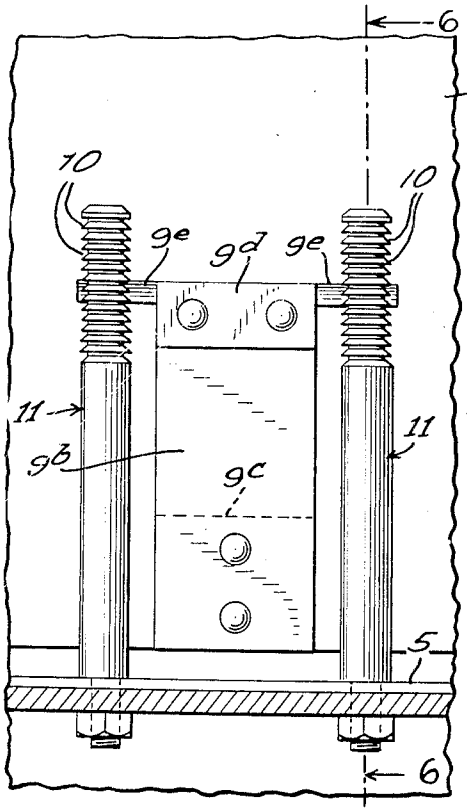
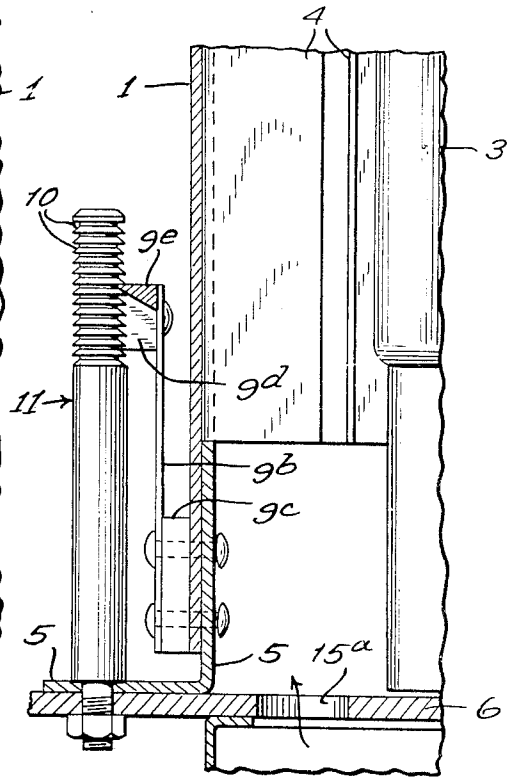


Fig. 6.



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TUBE SHIELD

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Application December 1, 1951, Serial No. 259,405

4 Claims. (Cl. 174—16)

The present invention provides a tube shield for air cooled vacuum tubes of the type employed in radio transmitters.

An object of the invention is to provide a novel and improved means for dissipating the radiant heat which is generated by the electrode structures of such tubes and preventing the radiant heat from being reflected back into the tube or transferred to surrounding parts and equipment.

Another object of the invention is to provide safety means responsive to temperature to interrupt the current supply to the tube in the event of failure of the cooling means, thus protecting the tube from danger due to excessive heat.

A further object of the invention is to provide means for supporting and holding the vacuum tube in the socket by lateral and vertical support means which tolerate a safe degree of tube displacement.

Another object is to provide improved cooling means for the electrode seals and tube surface.

Usually heretofore provision has been made for a nominally small amount of air to be blown over the tube and particularly the seals where leads are brought out from the electrodes. Principal reliance however, has been placed upon radiation to dissipate the heat energy generated within the tubes. Because little consideration has been given to means for effective disposal of the radiant energy, damage has often resulted to surrounding equipment due to their excessive increase in temperature. Also the ability of the tube to dissipate its heat properly is impaired when reflection of the radiant energy back into the tube is permitted. Such reflection can cause excessive tube temperature, shortened tube life, and generally poor circuit performance.

The means by which the desired temperature control is accomplished by my invention consist in the introduction into the immediate vicinity of the tube of a cylindrical shield which substantially envelopes the tube and which presents an inner surface capable of absorbing radiant heat from the tube and having sufficient area so that the absorbed heat can be transferred in turn to the cooling air by conduction with a low temperature gradient. Air is passed between the shield and the tube in sufficient volume to accomplish the adequate removal of heat from the tube shield. The air flow is also sufficient in volume to provide glass and electrode seal cooling of the tube. The flow of air can be maintained in sufficient volume with a low air pressure gradient by the arrangement herein contemplated, since large air passages are easily provided between the tube and the shield. This insures an economy of blower power. With provision for heat transfer first by radiation and then by conduction a high efficiency of cooling is achieved.

The ability of the tube shield to absorb radiant energy would be very little impaired though the shield temperature rises substantially. Should, however, the air flow become impaired or even fail and the tube shield become excessively hot, thermostatically controlled means are provided to shut down the tube. For example, a thermostat may be placed in contact with the shield and such construction offers a simple and safe means of shutting off the tube. It is apparent, therefore, that under no condition can the tube be damaged by its own generated heat because adequate radiation cooling of the tube prevails until the thermostat operates to open the tube circuit in the event the air flow should be insufficient or entirely fail.

Other benefits and advantages flowing from the type of shield construction disclosed in my invention will appear in the accompanying drawings and the following detailed description in which

Fig. 1 is an elevation of the tube shield and associated parts;

Fig. 2 is a top plan of the tube shield on enlarged scale with parts broken away;

Fig. 3 is a vertical sectional elevation taken on the angular line 3—3 of Fig. 2;

Fig. 4 is a fragmentary sectional detail on further enlarged scale of the holding means of Figs. 1, 2 and 3;

Fig. 5 is an enlarged fragmentary detail in elevation of modified retainer means for the shield; and

Fig. 6 is an enlarged section of the parts shown in Fig. 5 taken an line 6—6 of Fig. 5.

Referring to the drawings, the numeral 1 represents the cylindrical casing of the tube shield. There are provided on the inner surface of the cylindrical casing 1 channel shaped fins 4 angularly displaced from each other and axially mounted on the inner surface extending substantially the height of the tube shield less the height of retainer ring 5 which is flanged and secured to socket plate 6, as by rivets. The socket plate is provided with socket holes for tube terminals through which in known manner the terminal prongs on a tube 3 extend into a socket 6*a*. The sides of the fins 4 extend radially and inwardly to provide ample clearance for the tube 3. The tube shield is proportioned to telescope over and fit upon the retainer ring 5.

Spring clips 9, shown as two in number Fig. 2, are mounted on the lower portion of the outer cylindrical surface of the casing 1 of the tube shield. In the form shown in Figs. 1 to 4, each spring clip has its upper free end portion 9*a* curved outwardly and flaring in width for a distance and then reduced in width so as to form lateral shoulders the continuation beyond the shoulders constituting a tongue portion having straight sides and conforming substantially in width to that of the portion attached to the casing 1. The lateral shoulders engage notches 10 of two serrated posts 11 screwed into the flange 5 and the socket plate 6. The tongue portion of the member 9*a* extends between the two serrated posts 11, effectively restraining the tube shield from rotation. Engagement of the edges of the shoulders of the portion 9*a* with the serrated posts maintains the tube shield in its proper axial position with respect to the tube.

Another construction for a spring clip is shown in Figs. 5 and 6. This spring clip comprises a flat spring 9*b* the lower portion of which is attached to the tube shield by a spacing block 9*c*. A block 9*d* is attached to the outer and upper portion of the flat spring. The ends of the block 9*d* have wedge-shaped extensions 9*e* which are directed so as to engage the notches 10 of serrated posts 11 and accordingly lock the tube shield against axial or radial movement.

In the upper portion of the tube shield there are radially mounted on the inner surface pad supports 13 shown as three in number and spaced 120° apart in Fig. 2. Pad receiving component 13*a* of the pad support 13 is angularly bent upwardly in order that pad 14 mounted on its lower surface will exert both lateral and downward pressure against the glass envelope of the tube 3.

and thus prevent excessive lateral movement of the tube and support the tube in its socket. The pressure exerted by the pads against the tubes is not a rigid or unyielding one in as much as the action of the flexible spring clips 9 against the serrated posts 11, while indirectly supporting the tube in its socket, permits a certain amount of tolerance or play in tube movement in the event of shock or jarring. Being compressible the pads 14 also serve as shock absorbers for the tube. The pads are made of sponge material such as silicone rubber and must be able to withstand relatively high operating temperatures.

As shown the fins which are in the vertical planes of the pad supports are necessarily shorter than the other fins.

The shield is preferably metallic and aluminum has been found to be a satisfactory metal for most purposes. The inner surface of the aluminum tube shield and the aluminum fins is treated electrolytically to produce a surface of aluminum oxide and this surface is dyed with a dull black aniline dye to render it heat absorptive and non-reflecting. The air which is circulated between the tube and the cylinder and fins is blown by a blower 15 through large holes 15*a* in the socket plate 6 and spaced about the tube socket. The tube shield is open ended at its top and the air to which the heat energy is transmitted rises and is permitted to escape the vicinity of the tube and its surrounding parts through the vent 16.

On the outer surface of the cylindrical tube shield 1 is a bracket 17 which holds a thermostat 18. The thermostat being in metallic contact with the tube shield partakes of its temperature and houses, for example, a bimetallic switch 19 which makes or breaks circuit of a relay 20 which in turn controls the making or breaking of the main power circuit for the tube, as indicated in Fig. 1. The connection between the thermostat and the power to the tube may be established, of course, in various ways and the precise means adopted constitute no part of this invention. It is an important aspect of the invention, however, that thermostatic safety means are provided in the event of failure or impairment of air circulation within the tube shield. It is the heat absorbing and non-reflecting characteristics of the tube shield and fins which are exposed to the air flow which afford the primary protection to the tube and enhance its life expectancy.

The metallic nature of the tube shield, which substantially encloses the tube, protects it from the interference of radio frequency waves generated by the transmitter and which can greatly reduce the efficiency of radio tubes and conversely shields the surrounding equipment from radio frequency waves produced by the tubes.

Where vertical space limitations are encountered, the shield may, for example, consist of two half-cylinders, one being permanently fixed in place and the other being removably secured to it. The tubes may thus be afforded the protection of the tube shields, though the structural requirements of the transmitters may limit the space above the tubes to less than the height of the tube shield. Where this space is greater than the height of the tube shield the latter may be of integral construction as shown.

It is obvious that the fins may be integral with the shield, as by corrugations, and that other detail changes may be made in the construction shown in the drawings and above particularly described within the principle and scope of the invention as defined in the following claims.

What is claimed is:

1. In combination with a radio tube socket, a shield retainer, a cylindrical open ended aluminum shield surrounding the socket and secured by the retainer and having heat dissipating fins on its inner face, the inner surface of the shield including the fins being treated to form a coating of aluminum oxide thereon and being dyed with a dull black aniline dye, and blower means communicating with the space within the shield.

2. In combination with a radio tube socket, shield retaining means surrounding the socket, a cylindrical open ended metallic shield secured to said retaining means having axially disposed radial extensions on its inner face to provide substantial heat dissipating area, said face being substantially non-reflective of radiant heat, and blower means connected to force air through the space between the tube and the open ended shield in heat conducting contact with the shield.

3. The combination of claim 2 in which the said inner face has axial fins disposed thereon the exposed surface of which is substantially non-reflective of radiant heat.

4. The combination of claim 3 in which the shield and fins are aluminum and the inner surface of the shield including the fins is treated to form a coating of aluminum oxide thereon and is dyed with a dull black aniline dye.

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