July 6, 1965 G. M. WORDEN, SR 3,193,610

SHIELDS FOR VACUUM TUBES AND THE LIKE

Filed Aug. 10, 1962 2 Sheets-Sheet 1

FIG. 1

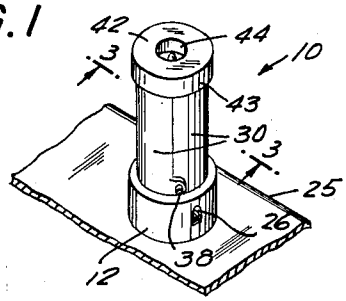


FIG. 3

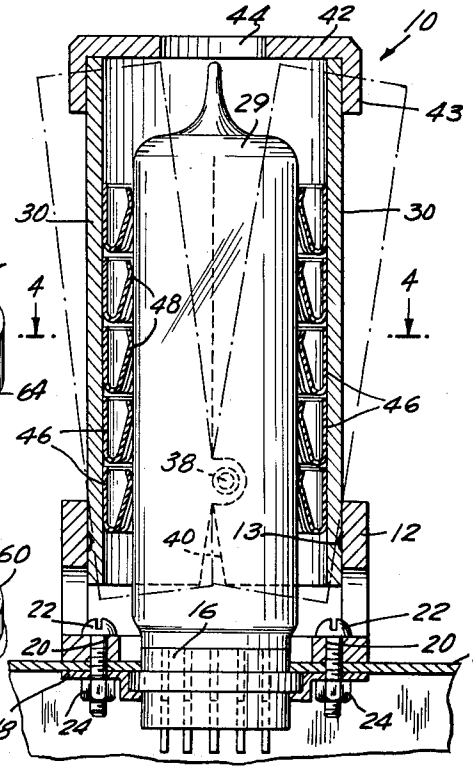
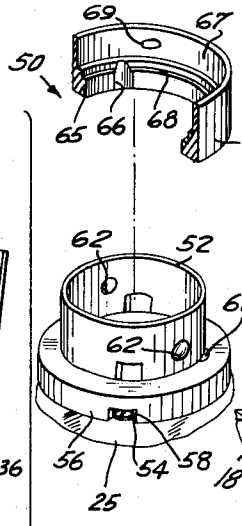


FIG. 6



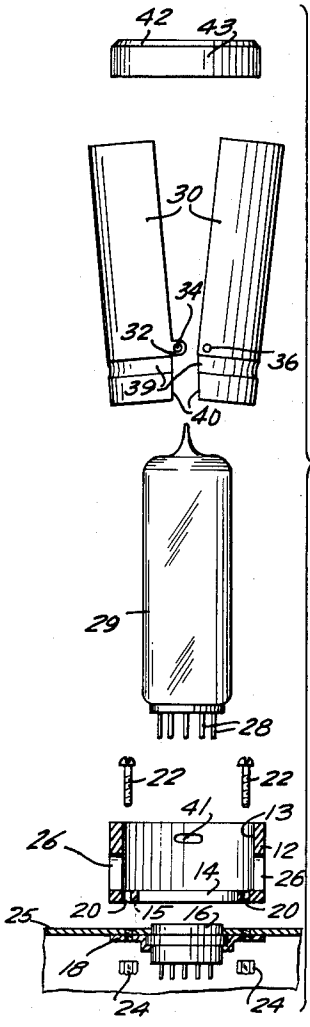


FIG. 2

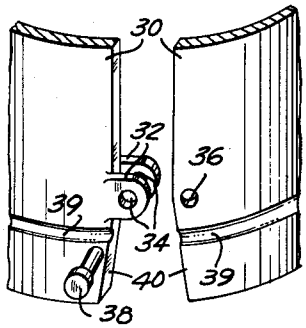
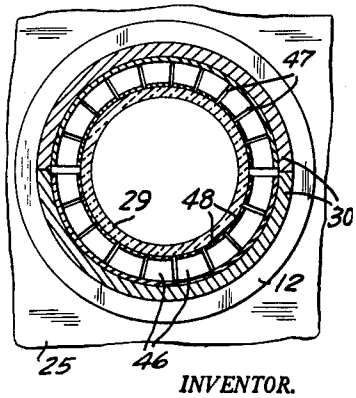


FIG. 5

FIG. 4



INVENTOR.
GEORGE M. WORDEN Sr.
BY Percy Truman
ATTORNEY

July 6, 1965 G. M. WORDEN, SR 3,193,610

SHIELDS FOR VACUUM TUBES AND THE LIKE

Filed Aug. 10, 1962 2 Sheets-Sheet 2

FIG. 7

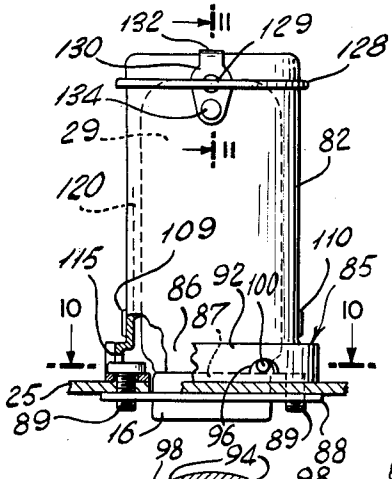


FIG. 9

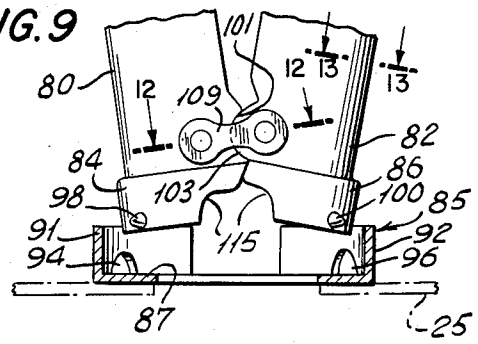


FIG. 13

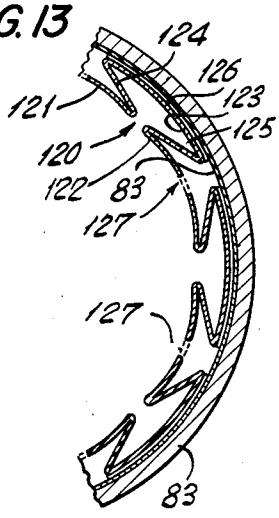


FIG. 11

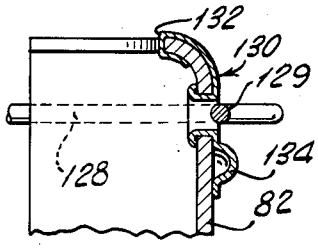


FIG. 10

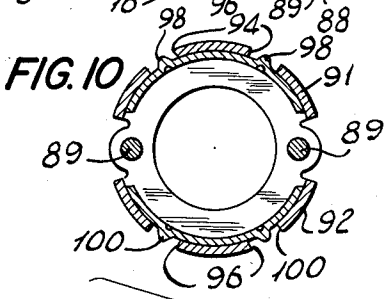


FIG. 12

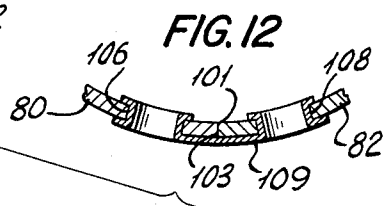
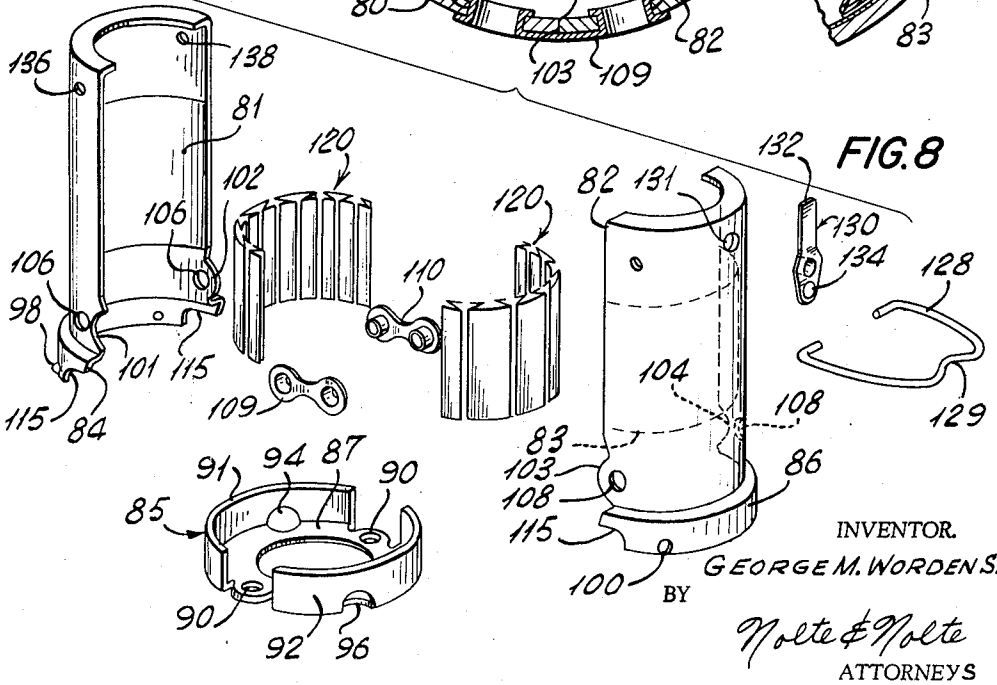


FIG. 8



INVENTOR.
GEORGE M. WORDEN SR.
BY
Nolte & Nolte
ATTORNEYS

United States Patent Office 3,193,610 Patented July 6, 1965

3,193,610

SHIELDS FOR VACUUM TUBES AND THE LIKE

George M. Worden, Sr., Manhattan, N.Y., assignor, by mesne assignments, to Atlee Corporation, Winchester, Mass., a corporation of Massachusetts

Filed Aug. 10, 1962, Ser. No. 219,356
18 Claims. (Cl. 174—35)

This application is a continuation-in-part of application Serial No. 86,650, filed February 2, 1961, now abandoned.

This invention relates to vacuum tubes and, more particularly, to a protective shield therefor.

Ordinarily, high operating temperature has a deteriorating effect upon all types of vacuum tubes, thus shortening their useful life, requiring frequent maintenance replacement and repairs, and reducing the reliability of the electronic system of which the vacuum tube is a component. To avoid such deleterious effects, vacuum tube shields are employed to remove the excess heat from the tube environment. In addition, a tube shield should also act as an electrical shield around the tube to reduce interaction due to stray fields. It should support the tube securely in its socket against vibration and impact in any plane, and it should protect the tube and its leads from mechanical injury.

There are three heat transfer paths from a bare tube: radiation from the envelope to surfaces which the envelope "sees," either natural convection or gaseous conduction from the envelope to the environmental air or gas surrounding the tube, and conduction along the tube lead wires. In brief, heavy gage, short length wire leads which are thermally grounded, tend to increase heat transfer by conduction. The terminals of the leads (away from the tube) must be kept cool if conduction is to be at all appreciable. In general, conduction along and convection from long lead wires on subminiature tubes is not appreciable.

The major mode of heat transfer from a bare vacuum tube is radiation. This is because the heat transfer by radiation is a function of the difference of the fourth power of the absolute temperatures, whereas, convection and gaseous conduction are functions of only the first power of temperature difference. If a tube is surrounded by lower temperature surfaces which are at distances greater than one inch from the tube, natural convection will occur. The heat transferred to these surfaces by convection will be less than that transferred by radiation. If the surrounding surfaces are very close, say, less than one-half inch away, and if the tube is enclosed in an airtight container, then free convection becomes ineffective and heat will be transfered by gaseous conduction to a smaller degree than that by radiation.

In order to be effective in removing heat from the envelope, the first and most important consideration is to provide a minimum of contact resistance between the tube shield, its base, and the chassis or mounting surface. The mounting surface should be of metal. Nothing is gained by mounting tube shields on, for example, a phenolic chassis, or on materials of low thermal conductivity. Such materials act as thermal insulators and it is easily possible to overheat a well shielded vacuum tube, even when it is operated well within its dissipation ratings. Ideally, for maximum heat transfer, the tube shield should be soldered, brazed or bonded to the metal surface to obtain a near perfect contact. Riveting or bolting a shield to a metal surface leaves a thin air gap which constitutes an extremely high thermal resistance, probably much more than the resistance of the shield itself. For effective heat removal, this gap must be minimized and preferably eliminated. A poor surface contact may cause

a shielded tube to operate hotter than a bare tube, even though other thermal considerations are incorporated in the design. It is not advisable to use a tube shield which is not thermally bonded to a cooler metal surface.

In addition, the shield should fit the tube envelope as tightly as possible to reduce the air gap to a minimum. Perfect contact with the bulb glass is difficult. One method which has found some use is to apply silicone grease between the tube and the shield. Unfortunately, this method is not usually suited to the maintenance techniques of the Armed Services. In general, the most practical method is to provide some flexibility in the shield to accommodate expansion and variation in bulb dimensions. For example, this can be accomplished by slotting or splitting the shield.

Further, it is desirable to increase the absorptivity of the inner surface of the shield to increase the heat transfer by radiation from the envelope. A brightly polished surface is a poor absorber and should not be used. A dull, oxidized and blackened surface is preferred. If heat transfer by radiation to the surroundings is desired, then the same dull surface should be used on the outer surface of the shield. On the other hand, if temperature sensitive parts and other tubes constitute the surrounding objects (in which case radiant heat transfer to these parts is not desired) then the shield's outer surface should be highly polished. Thus, the surrounding objects influence the design of the shield. In general, radiant energy should not be deliberately expended inside an electronic case. The heat is radiated from the source and dispersed to other parts in an uncontrolled fashion.

Accordingly, an object of the present invention is to provide an improved heat dissipating vacuum tube shield which will effective conduct the heat therefrom, thus avoiding overheating and overcoming the aforementioned difficulties.

Another object of the present invention is to provide a heat dissipating vacuum tube shield which will prevent accidental disconnection of the vacuum tube from its mounting socket.

Still another object is to provide a tube shield which will minimize the effects of impacts and vibrations to which the tube may be subjected.

It is a further object of this invention to provide a tube shield which will not weaken the tube envelope by scratching, scoring or marking the glass.

Still a further object is to provide a vacuum tube shield which can be readily adapted for use with standardized government specification parts, as well as commercial parts, to facilitate the use of this shield on all types of electronics equipment.

The objects of the invention are accomplished by providing an expansible tube shield having a plurality of spring elements secured hereto in an excellent heat conducting relationship, and adapted to contact the vacuum tube under pressure. The shield is held in a mounting ring secured to the chassis, so that when fully assembled, the pressure of the ring against the shield urges the resilient spring elements against the tube to improve the heat transfer and vibration dampening characteristics of the shield. The construction minimizes contact resistance between the shield base and chassis, while the shape of the spring elements enables a reduction of the air gap between themselves and the tube envelope. The interior surface of the shield may be additionally finished, as noted above, to further improve the heat absorption of the shield.

All of the foregoing and still further objects and advantages of this invention will be further explained with reference to the following specification, taken in connection with the accompanying drawing, wherein:

FIG. 1 is a top perspective view of a vacuum tube

shield assembly made in accordance with one form of the present invention in actual use.

FIG. 2 is an exploded side elevational view, partly in section, of the component parts of the assembly shown in FIG. 1.

FIG. 3 is an enlarged longitudinal cross-sectional view taken along line 3—3 of FIG. 1.

FIG. 4 is a transverse cross-sectional view taken along line 4—4 of FIG. 3.

FIG. 5 is an enlarged fragmentary perspective view of certain joint elements of the present invention.

FIG. 6 is an exploded perspective view, partly in section, of a slightly modified form of construction.

FIG. 7 is a front view, partly in section, of another embodiment of the invention.

FIG. 8 is an exploded perspective view of the embodiment of FIG. 7.

FIG. 9 is a side view, partly in section, of the hinge structure according to this embodiment.

FIG. 10 is a sectional view along the line 10—10 of FIG. 7.

FIG. 11 is a side sectional view along the line 11—11 of FIG. 7.

FIG. 12 is a sectional view along the line 12—12 of FIG. 9.

FIG. 13 is a transverse sectional view along the line 13—13 of FIG. 9.

Referring now to the drawing, and more particularly to FIGS. 1 to 5 thereof, a vacuum tube shield 10 made in accordance with the present invention for use with a standard tube socket 16, is shown to include a shallow cylindrical base 12 having an interior compartment 13 for purposes hereinafter described, and a radially inwardly directed flange 15 at one lower end defining a circular opening 14 receiving the upper end of the tube socket 16 therewithin.

The tube socket mounting ring 18 is secured to the metallic chassis 25 by means of bolts 22 and nuts 24, which bolts 22 are also received within a pair of opposed spaced openings 20 in the flange 15 thereby securing base 12 upon chassis 25 in proper assembled relationship with tube socket 16. It should be understood that the tube socket mounting ring 18 is an integral part of the tube socket 16. The side wall of the base 12 is also provided with a pair of diametrically spaced apart openings 26 in the vicinity of the bores 20 to facilitate the installation of the parts during assembly.

A vacuum tube having a glass envelope 29 and depending prongs 28, may be mounted in tube socket 16 in a conventional manner within the base 12. When so assembled, there is sufficient space between the envelope 29 and the inside of the base 12 to accommodate the insertion of the lower ends of a pair of sleeve halves 30, as will be hereinafter more fully described.

The sleeve halves 30, of substantially identical construction, serve as an expansible sleeve for reception at their lower end within the compartment 13 of the base 12, and for clamping engagement with the exterior of the glass envelope 29.

Each sleeve half 30 is provided with one or a pair of ears 32 on one side and an aperture 36 on the opposite side. Each such ear 32 is provided with an aperture 34 for alignment with the aperture 36 on the complementary side of the associated sleeve half for insertion of a rivet or hinge pin 38 therethrough. The apertures 34, 36 are located intermediate the opposite ends of the sleeve halves, but adjacent to the lowermost end thereof, the lower end of each half being slightly cut away to provide for limited movement of the sleeve halves toward the upwardly diverging position shown in FIGS. 2 and 3. This position of the sleeve halves constricts the size of the lowermost end thereof for insertion into the compartment 13 of the base 12 during the application of the shield to the base 12 and vacuum tube.

The interior of each shield half 30 is provided with non-removable rows of highly efficient heat conductive spring elements 46 having surfaces 48 defining a total generous heat dissipating area in pressure confronting relationship with the exterior surface of glass envelope 29. The inside diameter of the interior compartment formed by such contact surfaces 48 is slightly smaller than the exterior diameter of the glass envelope 29 with which it is to be used, thus stressing such elements upon application to the vacuum tube. By the nature of the application of the sleeve halves to the base 12, namely pressure applied to the upper ends of the sleeve halves to close the shield, a high pressure is provided between the surface 13 and bottom of the sleeve halves 30 by the mechanical advantage provided for by the juxtaposition of the fulcrum point 38 with respect to the ends of the sleeve halves 30. The base 12 being bolted to the chassis 25, provides high contact pressure between the bottom of flange 15 and the chassis 25. The high pressure contact at these interfaces provides a particularly effective heat transfer path for conducting heat from glass envelope 29 through the elements 46, sleeve halves 30, base 12, to the metallic chassis 25. The spring elements also prevent scratching, scoring, or marking of the glass envelope, which might result from any sliding of the shield with respect thereto.

The sleeve halves 30 are secured in clamping engagement with the envelope 29 by means of a clamp element 42 in the form of a lid having an annular side wall 43 of substantially the same diameter as the interior of the base 12. This element 42 may be readily slipped over the upper ends of the sleeve halves 30, as shown in FIGS. 1 and 3, to maintain the sleeve halves in a substantially parallel position. In this position the spring elements 48 are in pressure engagement with the exterior of envelope 29, thus insuring an effective heat path through the respective parts. This element 42 is also provided with a central opening 44 for facilitating the circulation of air through the shield, which circulation is further facilitated by the diametrically spaced apart openings 26 in the base 12 and the spaces 47 between adjacent heat dissipating elements 46 as clearly shown in FIG. 4.

With reference now to FIG. 6 of the drawing, a slightly modified form of mounting means 50 for the shield of the present invention, for use with standardized Joint Army-Navy type tube sockets 52, is shown to include a base ring 56 having a pair of opposed spaced apart recesses 58 for accommodating the heads 54 of the tube socket mounting screws therewithin. Ring 56 is also provided with a pair of opposite, spaced apart indents 60 which open radially inwardly of the ring to accommodate the passage of radially outwardly projecting detents 62 on the side wall of the tube socket 52.

The embodiment shown in FIG. 6 also includes a mounting ring 64 having a radially inwardly extending flange 65 with a pair of diametrically spaced apart and radially inwardly opening indents 66 for receiving detents 62 of tube socket 52. This inwardly extending flange 65 defines an upwardly facing, inclined surface 68 which is slidably engageable with the lower portions of the detents 62 of the base 52 in response to rotation of the ring 64 to clamp ring 64 in pressure engagement with the mounting ring 56 upon the chassis of the equipment. Thus, the interior 67 of the ring 64 serves in the same capacity as the interior 13 of the base 12 of the aforementioned embodiment for slidably receiving the lower ends of the sleeve halves 30 therewithin, such sleeve halves being received within the space between the tube socket 52 and the ring 64.

The base 12 of the embodiment illustrated in FIGS. 1 to 5, and the ring 64 of the embodiment illustrated in FIG. 6, are both provided with radially inwardly projecting detents 41, 69, respectively, which may be of any desired length, and which are received within at least a por-

tion of a groove 39 formed upon the exterior of each sleeve half 30 intermediate the hinge axis thereof and the lowermost ends thereof. This engagement effectively locks the sleeve halves within the base upon application of the clamp element 42 thereto, thus withstanding all types of impact and vibrational stresses during use.

Another embodiment of the invention is illustrated in FIGS. 7 to 13. In this embodiment, two semi-cylindrical shield sleeves 80 and 82 include wide diameter base regions 84 and 86, respectively. Sleeves 80 and 82 are plated on their interior surfaces at 81 and 83, respectively, with a material of good heat conducting properties (e.g. copper). A tube socket mounting ring 88 secures a tube socket 16 and is held beneath chassis 25 by means of two mounting screws 89. The shield mounting ring 85 includes an annular base 87 which may be secured to the top of chassis 25 by screws 89 passing through suitable apertures 90 in the base, chassis, and socket mounting ring.

Shield mounting ring 85 includes a pair of upstanding semi-cylindrical walls 91 and 92 integrally formed with base 87 and adapted to hold under pressure base regions 84 and 86, respectively, of sleeves 80 and 82. As shown in FIG. 10, a pair of apertures 94 at the junction of wall 91 and base 87 receive corresponding securing projections 98 of base region 84 to ensure the proper relationship between the tube and shield. Similarly, apertures 96 receive securing projections 100 of sleeve 82. To ensure pressure between the sleeves and the walls of the mounting means, the radii of base regions 84 and 86 are slightly greater than the radius of walls 91 and 92. In one operative construction, the outer diameter of the base region of the assembled shield was one inch, while the inner diameter of the walls of the mounting means was approximately four thousandths of an inch less.

Immediately above base region 84, the edges of sleeve 80 includes concave and convex portions 101 and 102, respectively, which are adapted to receive mating convex and concave portions 103 and 104, respectively, in the edges of sleeve 82 to form a socket-type hinge. The hinge portions of the two sleeves are properly shaped as shown to enable a slight pivotable movement from an upright position to the open position shown in FIGURE 9. The shield sleeves are held together by twin eyelets 109 and 110, which may be positioned in pivot holes 106 and 108 of sleeves 81 and 82, respectively. The eyelets are thereafter flanged over the inner surface of the sleeves as shown in FIG. 12 to pivotally secure the sleeve sections together. When the shield is open, the diameter of the base region is effectively decreased, enabling the shield to be readily positioned within walls 91 and 92 of mounting means 85. To permit rotation, each of the sleeve halves is cut away at its bottom portion as shown at 115. In addition, when the shield is assembled, these cut-out portions will be adjacent the spaces between upstanding walls 91 and 92 to provide an air intake for cooling purposes.

The resilient heat transfer and vibration damping means of this embodiment comprise a plurality of separate, elongated spring elements 120 as best shown in FIGURE 13. Since the individual spring elements are identical only one will be explained. Each comprises a pair of closely spaced, inner spring elements 121 and 122 whose curved inner faces are adapted to contact vacuum tube 29. Inner elements 121 and 122 are resiliently connected with an integral outer, curved portion 123 by opposing diagonal portions 124 and 125. The exteriors of outer portions 123 are soldered to copper plated sections 81 and 83 of respective sleeves 80 and 82. This connection enables particularly excellent heat transfer characteristics between spring elements 120 and sleeve halves 80 and 82.

If desired, an entire liner of corrugated metal having the configuration illustrated in FIGURES 8 and 13 may be secured to the individual sleeve halves and thereafter cut to form the individual spring elements. For example, paste solder 126 may be extruded and deposited upon the exterior surfaces of outer portions 123 which are to contact the copper plated areas of sleeves 80 and 82. After the liner has been properly positioned adjacent the plated sections, pressure may be applied to spread the paste solder over the area of contact between the sleeve and the liner. Thereafter, the soldering may be accomplished by a conventional induction heating cycle. After the liner has been properly secured to the sleeve halves, slots of about three hundredths of an inch may be made in the liner as indicated at 127 to form the individual spring elements described above. The assembly may thereafter be cleaned and chromated and at least the inner surface painted a dark color (e.g. black enamel).

To secure the shield sleeves together, a generally U-shaped closing wire 128 is employed in conjunction with a top eyelet 130 which is riveted into aperture 131 of tube sleeve 82. As shown in FIGURE 11, eyelet 130 includes an elongated, re-enforcing tab 132 and a small projection 134 immediately beneath the eyelet. The eyelet is secured in its proper position by bending projecting tab 132 over the top of sleeve 82. Closing wire 128 includes an indented tongue 129 and is rotatably supported in apertures 136 and 138 of sleeve 80, so that when the tube shield is assembled, indented portion 129 may be received in eyelet 130 to prevent the shield sleeves from parting. Closing wire 128 provides a high mechanical advantage to help close the sleeve halves under pressure. Tongue 129 is adapted to resiliently contact reenforcing tab 132 to force the sleeves together to their closed position, at which point tongue 129 is seated in the aperture of eyelet 130. The purpose of projection 134 is to prevent tongue 129 from being pushed down into contact with sleeve 82.

The tube shield of this embodiment is applied to the tube in the same manner as in the previous embodiment. After the mounting ring 85 has been properly secured around the socket of the tube and the tube has been inserted into the socket the shield halves are parted as shown in FIGURE 9 so that they may be readily inserted into the mounting ring. The shield is then positioned so that the securing projections 98 and 100 of base regions 84 and 86 lie adjacent their respective apertures 94 and 96. When the shield is properly situated, the sleeve halves are pivoted to their closed position, pushing the sleeve base regions 84 and 86 outwardly against upstanding walls 91 and 92 where they may be secured under pressure by means of closing wire 128. The increased pressure decreases the contact resistance between the shield and the chassis and also improves the vibration damping characteristics of the spring elements 120. Similarly, the soldering of the individual spring elements to the various sleeve elements improves the transfer of heat between these components, thus producing a tube shield with considerably improved heat transfer characteristics.

Thus, a high efficiency heat conductive, protective shield assembly has been provided which will protect a vacuum tube against damage due to heat, vibration, and impact forces, substantially prolonging the useful life of such equipment and minimizing replacement maintenance and repair thereof. A vacuum tube can be readily removed from the socket by removing the clamp element and allowing the sleeve halves to pivot to an open position while still mounted within the base ring. In the event that it is desired to remove the sleeve assembly from its base, this may be readily accomplished with no loss of parts in view of the hingedly connected relationship of the sleeve halves which facilitates the handling thereof as a single unit.

In actual use, the shield is located upon the tube with no downward pressure along the glass of the tube. Once the shield has been positioned, it is closed upon the tube without placing any load upon the pins of the tube either by axial or torsional loading thereof. This feature thus

allows for much higher pressure loading of the shield upon the tube. Furthermore, since the pressure is released prior to removing the shield from the tube, the removal can be effected without twisting the contact pins or removing the tube from the socket.

In addition to serving as a mechanical shock shield and heat dissipator, this device also serves as an electronic shield for grounding stray RF signals which might otherwise adversely affect the operation of the vacuum tube.

While the invention has been described with particular reference to the embodiments shown in the drawings, it is to be understood that this is not to be construed as imparting limitations upon the invention, which is best defined by the claims appended hereto.

What is claimed is:

1. A heat-dissipating vacuum tube shield comprising, in combination, a base, mounting means for securing said base in surrounding relationship with a tube socket, a pivotally expansible sleeve having one end receivable within said base and the other end expansible to a greater cross-sectional area than the said one end to receive a vacuum tube and the like, resilient elements in heat conductive relationship with the interior of said sleeve for pressure contact with the envelope of a vacuum tube mounted upon said tube socket, and clamp means carried by said sleeve and adapted to secure said heat conductive elements in pressure engagement with said envelope, the said expansible sleeve comprising a pair of semi-cylindrical sleeve halves tranversely pivotally connected together for restricted movement between a secured parallel position within said base and a released angularly open position.

2. A heat-dissipating vacuum tube shield as set forth in claim **1**, wherein said base comprises an annular ring receiving said one end of said sleeve therewithin, whereby movement of said sleeve halves to said parallel position effects pressure engagement with said one end of said sleeve halves with the interior of said ring.

3. A heat-dissipating vacuum tube shield according to claim **2**, wherein said resilient heat conductive elements comprise a plurality of separate elongated members, each of said members including an outer surface soldered to the inner wall of one of said sleeve halves, a pair of inner surfaces adapted to engage the exterior surface of the vacuum tube, and resilient means interconnecting said inner and outer surfaces.

4. A heat-dissipating vacuum tube shield according to claim **3**, wherein said clamp means includes a securing wire pivotally attached to one of said sleeve halves and securing means for said wire attached to the other of said sleeves.

5. A heat-dissipating vacuum tube shield as set forth in claim **2**, wherein said heat conductive elements comprise a plurality of yieldable fins integrally secured to the interior of said sleeve halves and defining a substantially cylindrical compartment of slightly smaller diameter than the diameter of a vacuum tube to be shielded in said parallel position of said sleeve halves, said fins yielding in response to engagement with the exterior of the glass envelope.

6. A heat-dissipating vacuum tube shield as set forth in claim **5**, wherein the exterior of said sleeve halves intermediate said one end thereof and the pivotal connection therebetween defines an indent, and said ring includes a radially inwardly projecting detent receivable within said indent of said sleeve halves in the parallel position of said sleeve halves to lock said sleeve halves in intimate assembly with said base.

7. A heat-dissipating vacuum tube shield as set forth in claim **6**, wherein said base ring further comprises a radially inwardly extending flange having an inclined surface facing toward said opposite end of said sleeve, said flange having a radially inwardly opening indent accommodating a radially outwardly projecting detent formed upon the side of the tube socket for wedging engagement upon said flange surface to secure said ring in intimate assembly with said tube socket.

8. A heat-dissipating vacuum tube shield as set forth in claim **7**, wherein said clamp means comprises a cap member having an annular side wall, said side wall releasably receiving said opposite ends of said sleeve halves therewithin for restricting radially outward separating movement thereof.

9. A heat-dissipating vacuum tube shield according to claim **1**, wherein said heat conductive elements are soldered to the inner surfaces of said sleeve halves.

10. A heat-dissipating vacuum tube shield according to claim **9**, wherein at least a portion of said inner surfaces are plated with a material having good heat conduction properties.

11. A shield for vacuum tubes and the like comprising, in combination, a pair of sleeve halves, transverse pivot means to enable the sleeve halves to pivot transversely from a secured parallel closed position to a non-parallel open position, a base to receive one end of the sleeve halves and to be held in secure engagement therewith when the said sleeve halves are in said parallel position, and means for holding the sleeve halves together in the secured parallel position in pressure engagement with the said base.

12. A shield for vacuum tubes and the like comprising, in combination, a pair of semi-cylindrical sleeve halves, the sleeve halves being transversely pivotally connected intermediately of the ends thereof to enable the said sleeve halves to pivot transversely from a secured closed parallel position to a non-parallel open position, a base to receive one end of the sleeve halves and to be held in secure engagement therewith when the said sleeve halves are in the said parallel position, and means for holding the sleeve halves together in the secured parallel position in pressure engagement with the said base.

13. A shield as claimed in claim **12** and in which the region of transverse pivoting is disposed near the base end of the sleeves.

14. A shield for vacuum tubes and the like comprising, in combination, a pair of semi-cylindrical sleeve halves, the sleeve halves being transversely pivotally connected intermediately of the ends thereof to enable the sleeve halves to pivot transversely from a secured parallel closed position to a non-parallel open position to receive the vacuum tube and the like therebetween, a base to receive one end of the sleeve halves and to be held in secure engagement therewith when the said sleeve halves are in the secured parallel position, means for holding the sleeve halves together in the secured parallel position in pressure engagement with the said base, and resilient elements in heat conductive relationship with the interior of the sleeve halves when the sleeve halves are in the said parallel position, at least one of the said sleeves being provided with a cut-away extending below the point of pivot to the said one end in order to enable movement of the lower ends of the said sleeves to the open position.

15. A shield for vacuum tubes and the like comprising, in combination, a pair of partial-cylindrical sleeves juxtaposed in parallel position with longitudinal edges of one partial sleeve adjacent the longitudinal edges of the other partial sleeve to form a cylindrical shell, the longitudinal edges of the partial sleeves being transversely pivoted together to enable the said sleeves to pivot transversely from the parallel position to a non-parallel open position, a base to receive one end of the partial sleeves when the said sleeves are in the non-parallel position and to be securely engaged by the said one end of the partial sleeves as they pivot from the non-parallel position to the parallel position, and means for holding the sleeves together in the secured parallel position in pressure engagement with the said base.

16. A shield as claimed in claim **15** and in which the sleeves are semi-cylindrical having wide diameter base

regions, and the base to receive the sleeves comprises semi-cylindrical walls and an integral bottom, the wide diameter base regions having projections and the semi-cylindrical walls having apertures to receive the said projections.

17. A shield as claimed in claim **15** and in which the pivot connection is near the said one end and in which the longitudinal edges from the pivot connection to the said one end comprises mating concave-convex portions to form a socket-type hinge.

18. A shield as claimed in claim **17** and in which the pivot connection comprises pivot holes in the respective sleeves at the said longitudinal edges and twin eyelets adapted to be received by the pivot holes pivotally to secure the sleeve sections together.

References Cited by the Examiner

UNITED STATES PATENTS

2,050,838	8/36	Hafecost et al.	174—35 X
2,080,913	5/37	Hafecost et al.	174—35 X
2,701,866	2/55	Chapman	174—35 X
2,807,659	9/57	Woods	174—35 X
2,862,991	12/58	Reardon	174—35 X
2,893,704	7/59	Passman	174—35 X

FOREIGN PATENTS

352,733	7/31	Great Britain.

DARRELL L. CLAY, *Primary Examiner.*

JOHN P. WILDMAN, JOHN F. BURNS, *Examiners.*