This invention relates generally to vacuum tubes and more particularly to a combination radiation shield and heat radiator for use with such tubes.

In radio and television receivers and transmitters it is frequently advantageous to provide grounded shields to prevent interference between certain vacuum tubes and other components of the circuits. This is particularly true when glass walled tubes are employed in the radio frequency portions of the circuits.

Most vacuum tubes will operate more efficiently over long periods of time if they are cooled so that they cannot become overheated, as is likely to occur when the heat developed by the tube filaments is not dissipated to the atmosphere at a high enough rate.

When conventional tube shields are employed to protect against radiation and stray fields the shields tend to decrease the rate of heat transfer from the tube to the atmosphere, with a result that the tubes are even more likely to become overheated so that their effective life is shortened.

Accordingly, one important object of this invention is to provide a tube shield which increases rather than decreases in the rate at which heat transferred from the tube yet which completely encloses the tube to prevent electrical interference.

Another object is to provide a cylindrical element which may be slipped over a metal walled vacuum tube, where shielding is of little importance, and which will increase the rate of heat transfer from the tube so that the tube will operate at a lower temperature.

A further object is to provide the tube shield which forms a finished around the tube, having vertically disposed air ducts along the sides of the tube so that the tube may be cooled by conduction, radiation and convection.

Another object is to provide a tube shield which may be easily fabricated from sheet material and whose diameter may be adjusted to suit various sized tubes.

Other objects and advantages of the combination tube shield and radiator of this invention will become apparent from a study of the drawings and appended claims.

In the drawing:

Fig. 1 is a perspective view of a glass walled vacuum tube provided with the shield of this invention.

Fig. 2 is an elevation showing the manner in which the shield of this invention is used with a glass walled tube having straight sides, the shield being shown in section.

Fig. 3 is a view similar to Fig. 2, showing another form of the shield installed on metal tube as a heat radiator.
edges 14 and 15 may be disengaged and made to overlap one or more additional corrugations to increase or decrease diameter of the shield 10, thus a given shield may be used with tubes of many different sizes, making it unnecessary to manufacture and stock large numbers of shields. The resiliency of the sidewall also makes it possible to use the shield 10 on non-circular cylindrical or prismatic objects since the shield tends to follow the shortest periphery when stretched over an object. This makes it possible to use the shield 10 on most types of circuit components including condensers.

In Fig. 2, a shield 10 is shown installed on a tube 11c having cylindrical sidewalls. In this installation no grounding ring is used, the fluted ends of the shield merely resting on the chassis 13 to ground the shield. In this installation the fluted sides of the shield 10 engage substantial portions of the tube wall to effect heat transfer by conduction from the tube to the shield. The lower end of the shield 10 is scalloped to provide air inlet ports 18 and engages the tube socket 20.

The manner in which the shield of this invention may be used as a cover for a metal tube 11b is shown in Fig. 3. In this case the function of the shield 10 is primarily to cool the tube 11b, and, accordingly, the shield is slipped directly over the metal shell of the tube and is not separately grounded. The shield 10, however, extends along its entire length to effect very good conductive heat transfer from the metal of the tube to the shield. The internal flutes 17b form a plurality of chimneys or ducts about the side of the tube through which cool air flows by convection, the chimney effect substantially increasing the rate of heat transfer over that which would occur if the tube were merely exposed to static air. The shield 10b differs from the preferred embodiment in that both its upper and lower ends are scalloped. Otherwise it is identical, the scalloping of the upper end serving no function when the top of the tube is not covered. The scalloped upper end results when a number of narrow strips are cut from a wide strip to form the blanks from which the shields are formed. This will be clarified in the description of Figs. 6-8 which follows.

In Fig. 4 a smaller sized shield 10c is shown installed on “peanut” or baseless type tube 11c. This embodiment, except for size, is substantially identical with that shown in Figs. 1 and 2.

In Fig. 5 a “peanut” tube 11d is provided with a grounding ring 12d surrounding the socket 20d and a two-piece shield 16d which completely encloses the tube. The side portion of the shield 16d is identical with the shield 10c, the shield being stretched somewhat to fit over the grounding ring 12d. To enclose the top of the tube 11d a cup shaped cap 21 is provided. This cap has preferably the same diameter as the ring 12d, and it is slipped inside the shield 16d so as to leave the upper ends of the flutes 17d open to the atmosphere, thus the circulation of air through the flutes and over the tube is not impeded by the cap 21. To prevent the accumulation of heated air about the tube, an opening 22 is provided in the center of cap 21. This opening also permits the tube to be readily inspected to see whether the filament is glowing.

Although a number of adaptations of the shield of this invention have been shown, the examples are not exhaustive and other modifications or combinations of the different adaptations may be made in order to meet particular situations. For example, the shield of Fig. 1 may be provided with a cap similar to that of the cap 21 shown in Fig. 4. It is possible to shield the top of the tube 11 if the tube to be shielded is of the type which has a connection terminal on the top, a larger opening 22 or other conventional arrangement would have to be provided in the cap 21 so that the lead wire to the top terminal would not touch the cap 21.

In some instances it has proved desirable to use a modified form of corrugation wherein the wave form is square or rectangular instead of sinusoidal. This produces somewhat better conductive heat transfer because of the larger area of contact.

A preferred method of making the corrugated shields of this invention is shown in Figs. 6-8. The first method is to sever an elongated strip of sheet metal into two halves along a sinusoidal line as indicated at 24. This cut 24 serves to form the scalloped edge which forms the inlet ports 16 after the strips have been corrugated. The next step of the process is to take either half of the longitudinally severed strip and pass it through a corrugating roll to give it the shape shown in Fig. 7. It is preferred that the scallops formed by the cut 24 be in register with the corrugations so that when the shield is formed each of the internal flutes 17 is provided with a port 18 at its lower end. However, registration between the scallops and the flutes is not necessary, and, if the period of the sinusoidal variation of the scalloped edge is different from the period of the sinusoidal corrugation, random spacing will result with the further result that the bottoms of the flutes 17 will be sufficiently open to permit free air flow.

In Fig. 8, a corrugated strip is shown after having been cut to length and bent to form a cylinder. The step of cutting the corrugated length may be performed before the corrugation step, if desired, and when this is done the corrugated rollers can be so arranged to bend the strip into a cylinder during corrugation.

From the foregoing, it will be apparent that a superior shield has been provided, which not only encloses the circuit element to be shielded but also promotes the cooling thereof and is useful as a cooling element even when shielding is not required, moreover, the device of this invention is universal in size so as to accommodate tubes or elements of different diameters and shapes and is inexpensively and easily fabricated. Various other changes or modifications in addition to those set forth herein and as such will present themselves to those familiar to the art may be made without departing from the spirit of this invention the scope of which is commensurate with the following claims.

What is claimed is:

1. In combination a vacuum tube mounted in a tube socket, a grounding ring surrounding said socket, and a tube shield supported upon said grounding ring in slidable, telescoping relationship therewith and enclosing the sides of said tube, said shield comprising a corrugated piece of sheet metal affording vertical air flow channels and bent to form a corrugated tube substantially the same as said tube, the bottom of said shield having an irregular edge to provide air inlet openings sidewaysly into the air flow channels formed by the corrugations adjacent to said grounding ring.

2. A combination wave shield and heat dissipating accessory slidably received on thermionic valves which comprises a cylindrical jacket constructed of circumferentially undulating springable sheet metal coextensive longitudinally with the envelope of a valve and forming alternate inner and outer longitudinally disposed flutes, the inner flutes having tangential contact with the periphery of the envelope and the spaces intervening the flutes forming vertical chimney flues stimulated by the radiant and convected heat emanating from the valve, and means for increasing the accessibility for replacement air to said flues comprising a lowermost sliding portion of said jacket scalloped at coincidence with said undulation.

3. In combination a vacuum tube mounted in a tube socket, a grounding ring surrounding said socket, and a tube shield supported upon said grounding ring in slidable telescoping relationship therewith and enclosing the sides of said tube, said shield comprising an undulated piece of sheet metal bent to form a cylinder having an internal diameter substantially the same as the maxi-
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5 mum diameter of said tube, the bottom of said shield having an irregular edge to provide air inlet openings sideewardly into the internal flutes: formed by the corrugations adjacent to said grounding ring, and a cup shaped cap shield having a flange of approximately the same diameter as the ring received in readily removable sliding relationship within the upper end of the shield to leave the upper ends of the flutes open to the atmosphere, said internal flutes providing air flow chimneys whose upper inner walls are defined by said cap.

4. The combination called for in claim 3 in which the cup shaped cap telescopes in sliding relationship to a depth in the shield limited only by the tube itself to leave the top of said flutes open and unobstructed in a vertical direction.

5. A readily installed and removable radiation shield slidably received upon an electron discharge tube comprising a corrugated sheet metal member of high heat conductivity bent to a cylindrical form with edges overlapping different distances to afford different inside diameters, said corrugations extending longitudinally of said member to encompass and contact the tube along the inner folds of the corrugations to provide intermediate vertically disposed air passageways defined by protuberant flutes, said sheet metal corrugations being of springable stock permitting expansion of the shield to accommodate a range of variations in tube dimensions, the heat of said tube inducing convective flow of air through said passageways in direct contact with the tube, and means for increasing the intake capacity through said passageways comprising inclined cutaway portions at the lower ends of said corrugations affording lateral intake of air to said passageways.

6. A radiation shield slidably received upon an electron discharge tube which comprises an encircling jacket of corrugated sheet metal formed to present alternate and opposite flute formations of sinusoidal cross-section, the sheet metal of said shield jacket being of thin flexible stock whereby to afford garter-like stretching to accommodate for variations of tube envelope circumferences while permitting a chimney forming engagement of the internal flute formations in heat exchange contact against the tube periphery along the entire tube length, and a top closure for said shield comprising a plug formed cylinder cap with sides proportioned to have telescoping engagement with said flute formations at one end of said shield bottom of said shield having an irregular edge to provide air inlet openings sidewardly into the internal flute formations formed by the corrugations.

7. In combination a vacuum tube mounted in a tube socket, a grounding ring surrounding said socket, and a tube shield supported upon said grounding ring in slidable telescoping relationship therewith and enclosing the sides of said tube, said shield comprising a corrugated piece of sheet metal bent to form a cylinder having an internal diameter substantially the same as the maximum diameter of said tube, the bottom of said shield having an irregular edge to provide air inlet openings into the internal flutes formed by the corrugations adjacent to said grounding ring, and a cup shaped cap shield having a flange of approximately the same diameter as the ring received in readily removable sliding relationship within the upper end of the shield to leave the upper ends of the flutes open to the atmosphere, said shield having overlapping interlocking nesting edges capable of engagement in a plurality of different relationships to provide a shield of different diameter.

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