Nov. 18, 1947. W. ZELINKA 2,431,157

ELECTRON DEVICE AND RADIATOR

Filed Jan. 11, 1944

Fig. 1.

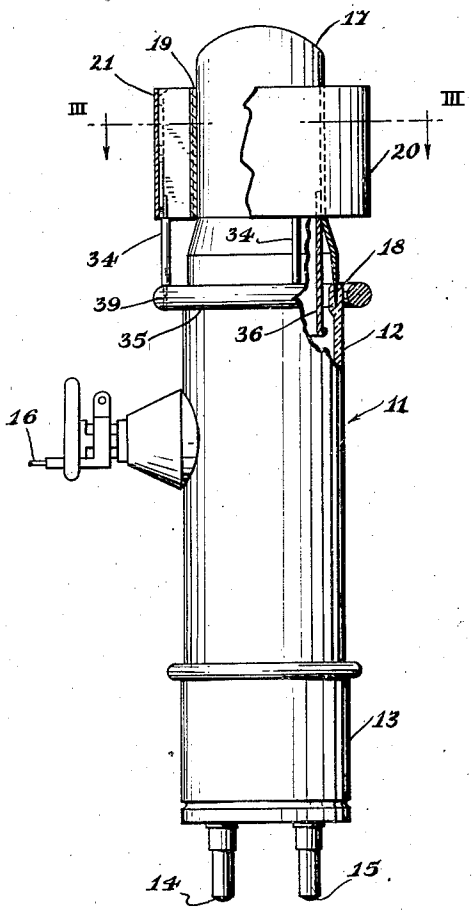


Fig. 2.

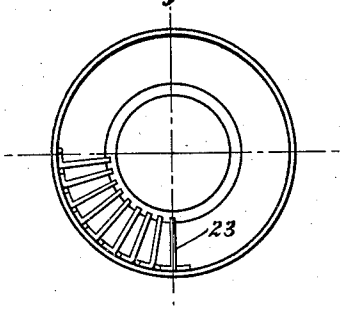


Fig. 3.

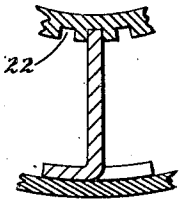


Fig. 4.

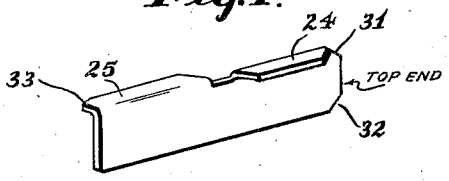


Fig. 5.

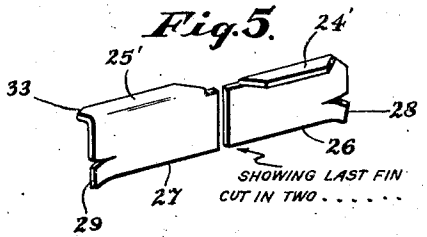
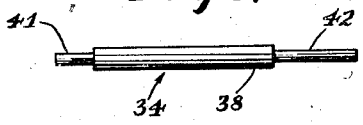


Fig. 6.



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ELECTRON DEVICE AND RADIATOR

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16 Claims. (Cl. 250—27.5)

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This invention relates to electron devices and, more particularly, to radiators used for cooling electrodes thereof.

The primary object of my invention, generally considered, is to provide an electron device radiator comprising cooling fins so constructed and arranged that they will remain radial at all times.

Another object of my invention is to provide a radiator of the type mentioned in which the cooling fins are locked into position and cannot fall out accidentally.

A further object of my invention is to provide corona ring supporting pins of such shape that the ring may be conveniently spaced accurately with respect to the radiator during assembly.

A still further object of my invention is to provide a device of the character specified which is considerably simpler to assemble, provides a more efficient structure of pleasing appearance, and is considerably cheaper to fabricate than previous devices of the type under consideration.

Referring to the scale drawing:

Fig. 1 is an elevational view, with parts in section, of an electron device embodying my invention.

Fig. 2 is a plan of the radiator of Fig. 1 detached from the electron device and showing only some of the fins in place.

Fig. 3 is an enlarged fragmentary sectional view of the radiator on the line III—III of Fig. 1.

Fig. 4 is a perspective view of one of the fins prior to incorporation in the radiator.

Fig. 5 is a perspective view of the two-part fin which is applied last in manufacturing a radiator embodying my invention.

Fig. 6 is an elevational view of one of the corona ring supporting pins embodying my invention.

Referring to the drawing in detail, like parts being designated by like reference characters, there is shown an electron device 11 comprising an enclosing vitreous envelope 12, a base 13, with lead-in contact members 14 and 15 for the cathode (not shown), a connection 16 for the grid (not shown) and an anode 17 formed with a sharpened edge portion 18 sealing to one end of the vitreous envelope 11, as illustrated. The anode member, therefore, presents an external surface which, in the present embodiment, is cylindrical and representative of electrode surfaces which may be cooled in accordance with my invention.

A former type of radiator for such an electrode consists of an inner metal ring, preferably of copper, provided with a plurality of longitudinal

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slots on the outer face thereof, an outer metal ring, preferably of copper, of greater diameter than the inner ring, positioned concentrically with respect thereto and maintained in place by a plurality of cooling fins, each of which has an edge portion seated in one of the outwardly opening slots, each fin consisting of an L-shaped strip of metal such as copper having a normally radial body portion and a flange or foot at its outer end extending at an angle thereto and normally engaging the inner surface of the outer ring.

Considerable difficulty had been experienced in the assembling of radiators of this type since if a certain relative turning movement occurred between the inner and outer rings, the fins would move out of their normal radial positions and be misaligned, with a tendency to fall out of the assembly. This difficulty has been very troublesome in actual factory production and is eliminated by my invention.

In accordance with my invention I employ inner and outer hollow cylinders or rings 19 and 21, respectively, the inner ring 19 closely fitting the exterior cylindrical portion of the electrode 17 so as to lie in heat conductive relationship with respect thereto. Said inner ring is preferably provided with closely spaced outwardly or radially opening slots 22 running parallel to the ring axis and desirably uniformly spaced around the ring periphery, as illustrated in Figs. 2 and 3. Each fin 23, except the last one to be assembled, has instead of a single flange, a pair of flanges 24 and 25, as shown in Fig. 4.

These flanges are bent in opposite directions and serve not only to accurately space the outer edge portions of each fin from its neighbors, but also to keep said fins positioned radially between the outer and inner rings. This radial position is maintained by virtue of the interfitting of the flanges on the adjacent rings. Furthermore the shape and location of these flanges makes it necessary to assemble the fins one after another in rotation around the radiator, as will be obvious from the drawing. When the radiator assembly is completed it will not be possible to remove any one of the fins, heretofore described, without removing its neighbor, since one flange of each fin overlaps circumferentially and is in abutting relation with a flange on each of the adjacent fins.

This particular construction would make it impossible to position the last fin in the assembly if it were shaped in the manner shown in Fig. 4. I, therefore, overcome this difficulty by cutting such last fin into two sections, as shown in Fig.

5, and inserting one section 26 from the normally upper side of the radiator and the other section 27 from the normally lower side thereof. The upper section 26 carries a flange 24' corresponding with the flange 24 of the other fins, and the lower section 27 carries a flange 25', corresponding with the flange 25 of the other fins. In addition to these flanges the section 26 carries a lug 28, cut therefrom, and the section 27 carries a lug 29, similarly formed, to prevent either of the pieces sliding out of place with respect to the radiator assembly during the procedure of manufacturing. The foregoing description is, of course, on the assumption that the fins are inserted parallel to the axis between the inner and outer rings 19 and 21. If, however, the fins are inserted radially into the slots 22 in the inner ring 19, of course prior to application of the outer ring 21, they may all be formed as illustrated in Fig. 4 as the flanges 24 and 25 do not interfere with one another in radial application or removal. Of course during such assembly some means for keeping the fins in the slots 22 such as an elastic band is needed, assuming the fins do not tightly fit the slots.

As shown in Fig. 4 the upper corners of each fin are cut off or beveled as indicated at 31 and 32. When the fins are in position this configuration provides annular grooves into which brazing material may be placed adjacent the inner and outer rings, 19 and 21. One corner of each bottom flange 25 is also desirably cut off or beveled, as indicated at 33, for convenience in assembling.

After the parts have been assembled, a ring of brazing material may be placed in the annular grooves provided between beveled upper corner poritions 31 and 32 and the whole assembly placed in a furnace, while protected from oxidation, until the brazing material has melted and run down to unite the engaging edge portions of the fins and rings, thereby not only holding the parts firmly together but improving the ability of the radiator to dissipate heat.

I have also made an improvement in the pins 34 which support the corona ring 35 from the radiator 20. The purpose of this ring 35 is to reduce the electric gradient at the junction of the glass or vitreous material 12 and the metal of the electrode 17. This result is accomplished by providing an interior metal sleeve 36 depending from the inside of the anode 17, downwardly past the region of the junction between the thin edge portion 18 and the vitreous envelope 21. Outside of the envelope directly beyond the junction, the corona ring 35 is suspended by pins 34, as shown in Fig. 1. Formerly these pins were made of uniform diameter and the spacing between the radiator and the corona ring had to be carefully adjusted.

My new pin obviates this difficulty by involving a central portion 38, relatively large in diameter, which is too big to pass between the radiator pins or into the pockets or holes 39 in the corona ring 35. The spacing between the radiator and the ring is, therefore, determined by the length of this relatively large section. The relatively small portion 41 fits the corresponding pocket or hole 39 in the corona ring until the shoulder between it and the enlarged portion engages the exterior surface of said ring and the relatively small portion 42 fits between fins of the radiator, as far as it will go, until the shoulder between it and the relatively large portion 38 engages the lower end portions of said fins.

As an alternative the enlarged portion 38 may be formed as a sleeve fitting a smaller pin portion of uniform diameter or section, said sleeve determining the spacing between the corona ring and the radiator axially of the device, and the ends of the smaller pin fitting and respectively secured to the radiator and corona ring.

From the foregoing it will be seen that I have provided an improved radiator and corona ring assembly adapted for use with electron devices for cooling electrodes thereof. It will also be understood that all of the fins but one are formed each with two oppositely directed flanges, so that they may be assembled in rotation between two concentrically spaced rings, the assembly being completed by the positioning of the parts of the final fin. This fin is cut in two, so that one part carries one flange and the other part the other flange. One of these part fins is assembled by insertion from the top of the radiator and the other by insertion from the bottom. The alternative or radial method of assembly previously described may, of course, be employed. Although I have shown this associated with a particular type of electron device, it will be understood that I do not wish to be limited thereto, as it is suitable for use on other electron devices, including X-ray tubes.

Although a preferred embodiment of my invention has been disclosed, it will be understood that modifications may be made within the spirit and scope of the appended claims.

I claim:

1. In combination, an electron device comprising an enclosing envelope, a metal electrode secured to and having at least a part projecting outside of said envelope, an inner metal ring encircling and secured to said outside part for transferring heat therefrom by conduction, a plurality of metal fins projecting radially therefrom, and an outer metal ring encircling said fins, each fin having a uniform radial dimension corresponding with the radial distance between said rings and bifurcations bent in opposite directions from its plane, overlapping circumferentially with those of adjacent fins having their outer surfaces conforming in curvature with that of the inner surface of the outer ring, and secured to the inner surface of said outer ring, to maintain the positioning of said fins.

2. In combination, an electron device comprising an enclosing envelope, a metal electrode secured to and having at least a part projecting outside of said envelope, an inner metal ring encircling and secured to said outside part for transferring heat therefrom by conduction, said ring having a plurality of outwardly opening radial grooves substantially uniformly spaced around its periphery, a corresponding number of metal fins, each having one edge portion fitting in a groove so that it projects radially outward therefrom, and an outer metal ring encircling said fins, each fin having a uniform radial dimension corresponding with the radial distance between said rings and bifurcations at its outer end bent in opposite directions from the plane thereof, overlapping circumferentially with those of adjacent fins, and secured to the inner surface of said outer ring, to maintain the positioning of said fins.

3. In combination, an electron device comprising an enclosing envelope, a metal electrode secured to and having at least a part projecting

outside of said envelope, an inner metal ring encircling and secured to said outside part for transferring heat therefrom by conduction, a plurality of metal fins projecting therefrom, and an outer metal ring encircling said fins, each fin having a uniform radial dimension corresponding with the radial distance between said rings and a pair of flanges bent in opposite directions from its plane, overlapping circumferentially with those of adjacent fins, having their outer surfaces conforming in curvature with that of the inner surface of the outer ring, and secured to the inner surface of said outer ring, to maintain the positioning of said fins.

4. In combination, an electron device comprising an enclosing envelope, a metal electrode secured to and having at least a part projecting outside of said envelope, an inner metal ring encircling and secured to said outside part for transferring heat therefrom by conduction, said ring having a plurality of outwardly opening radial grooves substantially uniformly closely spaced around its periphery, a corresponding number of metal fins each having one edge portion fitting in a groove so that it projects radially outwardly therefrom, and an outer ring encircling said fins, each fin having a uniform radial dimension corresponding with the radial distance between said rings and a pair of flanges at its outer end projecting in opposite directions from the plane thereof, overlapping circumferentially with those of adjacent fins, having their outer surfaces conforming in curvature with that of the inner surface of the outer ring, and secured to the inner surface of said outer ring to maintain the positioning of said fins.

5. A radiator adapted to cool an electrode and comprising an inner metal ring, a plurality of metal fins projecting equal distances radially therefrom, and an outer metal ring encircling said fins, each fin having bifurcations bent in opposite directions from its plane, overlapping circumferentially with those of adjacent fins, having their outer surfaces conforming in curvature with that of the inner surface of the outer ring, and secured to the inner surface of said outer ring, to maintain the positioning of said fins.

6. A radiator adapted to cool an electrode and comprising an inner metal ring having a plurality of outwardly opening radial grooves substantially uniformly closely spaced around its periphery, a corresponding number of metal fins each having one edge portion fitting in a groove so that it projects radially outward therefrom, and an outer metal ring encircling said fins, each fin having a uniform radial dimension corresponding with the radial distance between said rings and bifurcations at its outer end bent in opposite directions from the plane thereof, overlapping circumferentially with those of adjacent fins, and secured to the inner surface of said outer ring.

7. A radiator adapted to cool an electrode and comprising an inner metal ring, a plurality of metal fins projecting therefrom, and an outer metal ring encircling said fins, each fin having a uniform radial dimension corresponding with the radial distance between said rings and a pair of flanges projecting in opposite directions from its plane, overlapping circumferentially with those of adjacent fins, having their outer surfaces conforming in curvature with that of the inner surface of the outer ring, and secured to the inner surface of said outer ring, to maintain the positioning of said fins.

8. A radiator adapted to cool an electrode and

comprising an inner metal ring having a plurality of outwardly opening radial grooves substantially uniformly spaced around its periphery, a corresponding number of metal fins each having an edge portion fitting in a groove so that it projects radially outward therefrom, and an outer ring encircling said fins, each fin having a uniform radial dimension corresponding with the radial distance between said rings and a pair of flanges at its outer end bent in opposite directions from the plane thereof, overlapping circumferentially with those of adjacent fins, having their outer surfaces conforming in curvature with that of the inner surface of the outer ring, and secured to the inner surface of said outer ring, to maintain the positioning of said fins.

9. A radiator adapted to cool an electrode and comprising an inner metal ring with outwardly-opening radial grooves, a plurality of metal fins fitting all of said grooves but one and projecting therefrom, and an outer metal ring encircling said fins, each of said fins having a uniform radial dimension corresponding with the radial distance between said rings and a pair of flanges bent in opposite directions from its plane, overlapping circumferentially with those of adjacent fins, and secured to the inner surface of said outer ring, said last groove holding one fin having a flange bent in one direction and another generally coplanar therewith and having a flange bent in the other direction, so that the two together when assembled form the equivalent of one of the first-mentioned fins, whereby it is possible to by axial movement between the rings assemble all of the fins, one after the other, except the last two, and then assemble the last by inserting one axially from one end and the other axially from the other end of the assembly.

10. A radiator adapted to cool an electrode and comprising an inner metal ring having a plurality of outwardly opening grooves substantially uniformly spaced around its periphery, metal fins corresponding in number with all of said grooves but one, each having an edge portion fitting in a groove so that it projects radially outward therefrom, and an outer ring encircling said fins, each fin having a uniform radial dimension corresponding with the radial distance between said rings and a pair of flanges at its outer end bent in opposite directions from the plane thereof, overlapping circumferentially with those of adjacent fins, and engaging the inner surface of said outer ring, the remaining groove having a relatively short fin having a flange extending in a direction corresponding with that of the flanges on the adjacent fin portions and another relatively short fin inserted having a flange extending in the direction opposite from that of its complementary fin portion, thereby making it possible to assemble said fins by axial movement between said rings.

11. The method of making a radiator comprising forming an inner metal ring with a plurality of outwardly opening radial grooves substantially uniformly spaced around its periphery, forming fins each having a pair of flanges at one end bent in opposite directions from the plane thereof, fitting the unflanged edge portion of each of said fins in said grooves, so that each fin projects radially outward therefrom and oppositely-extending flanges of adjacent fins overlap circumferentially and fitting an outer ring around all of said fins so that said flanges engage the inner surface thereof.

12. The method of making a radiator compris-

ing forming an inner metal ring with a plurality of outwardly opening grooves substantially uniformly spaced around its periphery, then placing an outer ring around said inner ring sequentially inserting in all of said grooves except one, metal fins axially between said rings, while edge portions are disposed radially in said grooves, each of said fins having a pair of flanges at its outer edge bent in opposite directions from the plane thereof and engaging the inner surface of said outer ring so that the oppositely-extending flanges of adjacent fins overlap circumferentially, then sliding a short fin formed with only one flange into one end portion of the remaining groove in said inner ring, and finally sliding another short fin complementary in length with the first-mentioned short fin from the other end of said radiator into said groove and formed with a flange extending in the opposite direction from the flange of the other short fin.

13. In combination, an electron device comprising an enclosing envelope, a metal electrode secured to and having at least a part projecting outside of said envelope, a radiator comprising an inner ring encircling said outside part and having fins extending radially therefrom, a pocketed corona ring encircling said envelope, and pins projecting from said radiator into said corona ring for holding the latter in place, each pin having a central portion, relatively large in diameter, and which is too big to pass between the radiator fins or into the pockets in the corona ring and end portions which respectively fit between said radiator fins and into said pockets, whereby the spacing of the ring with respect to said radiator is conveniently determined by the length of said relatively large portion.

14. In combination, an electron device comprising an enclosing envelope, a metal electrode secured to and having at least a part projecting outside of said envelope, a radiator comprising an inner ring encircling said outside part and having fins extending radially therefrom, a pocketed corona ring encircling said envelope, and pins projecting from said radiator into said corona ring for holding the latter in place, each pin having a sleeve enclosing its central portion, relatively large in diameter, and which is too big to pass between the radiator fins or into the pockets in the corona ring and the end portions of said enclosed pin respectively fitting between said radiator fins and into said pockets, whereby the spacing of the ring with respect to said radiator is conveniently determined by the length of said sleeve.

15. The method of making a radiator comprising forming an inner metal ring with a plurality of outwardly opening radial grooves substantially uniformly spaced around its full periphery, forming fins of uniform width at least nearly all of which have a pair of flanges at one end bent in such a way and extending in opposite directions from the planes thereof so as to seat on the inner surface of an outer ring, and assembling such fins so that they extend radially between said inner metal ring and an outer ring, the unflanged portions of said fins fit in said grooves and the flanges on adjacent fins overlap circumferentially and snugly engage the inner surface of the outer ring to maintain the radial positioning of said fins.

16. The method of making a radiator comprising forming a metal cylinder with a plurality of outwardly opening grooves substantially uniformly spaced around its peripheral surface and each extending parallel to the axis, constructing a plurality of metal fins of uniform width, each with a side edge portion bifurcated and the metal portions at each side of the bifurcation bent in opposite directions from the plane of the fin to provide a pair of flanges, constructing a fin of corresponding width but relatively short, with a side edge portion bent to provide only one flange corresponding with a flange of one of the first-mentioned fins, constructing another relatively short fin of corresponding width, complementary in length with respect to the first mentioned short fin, with a side edge portion bent to provide only one flange, corresponding with the other flange of the identified one of the first-mentioned fins, adapted to extend in a direction opposite to the flange of said first-mentioned short fin, placing a hollow metal cylinder, having an inner radius larger than the radius of the first-mentioned cylinder at the bottoms of the grooves by an amount corresponding approximately with the width of said fins, around said first-mentioned cylinder, then sequentially inserting said double-flanged fins, one at a time, axially between said cylinders, while their unflanged edge portions are disposed radially in said grooves, so that the oppositely-extending flanges of adjacent fins overlap circumferentially, then inserting one of said short fins axially between said cylinders, while its unflanged edge portion is disposed radially in the remaining groove, so that its flange fits between the flanges projecting in the corresponding direction from the fins on opposite sides thereof, and finally inserting the other short fin axially between said cylinders, while its unflanged edge portion is disposed radially in the other end portion of said remaining groove, so that its flange extends in the direction opposite to that of the other short fin and fits between the flanges projecting in the corresponding direction from the fins on opposite sides thereof.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,341,752	West	Feb. 15, 1944
1,721,878	Grimes	July 23, 1929
1,976,101	Zeigler	Oct. 9, 1934
2,289,984	Mouromtseff et al.	July 14, 1942
1,821,080	Sprong	Sept. 1, 1931
2,176,657	Finch	Oct. 17, 1939
2,191,349	Lengyel	Feb. 20, 1940
1,529,190	Kettering	Mar. 10, 1925
1,735,213	Purdy	Nov. 12, 1929
2,341,752	West	Feb. 15, 1944