

Feb. 15, 1944.

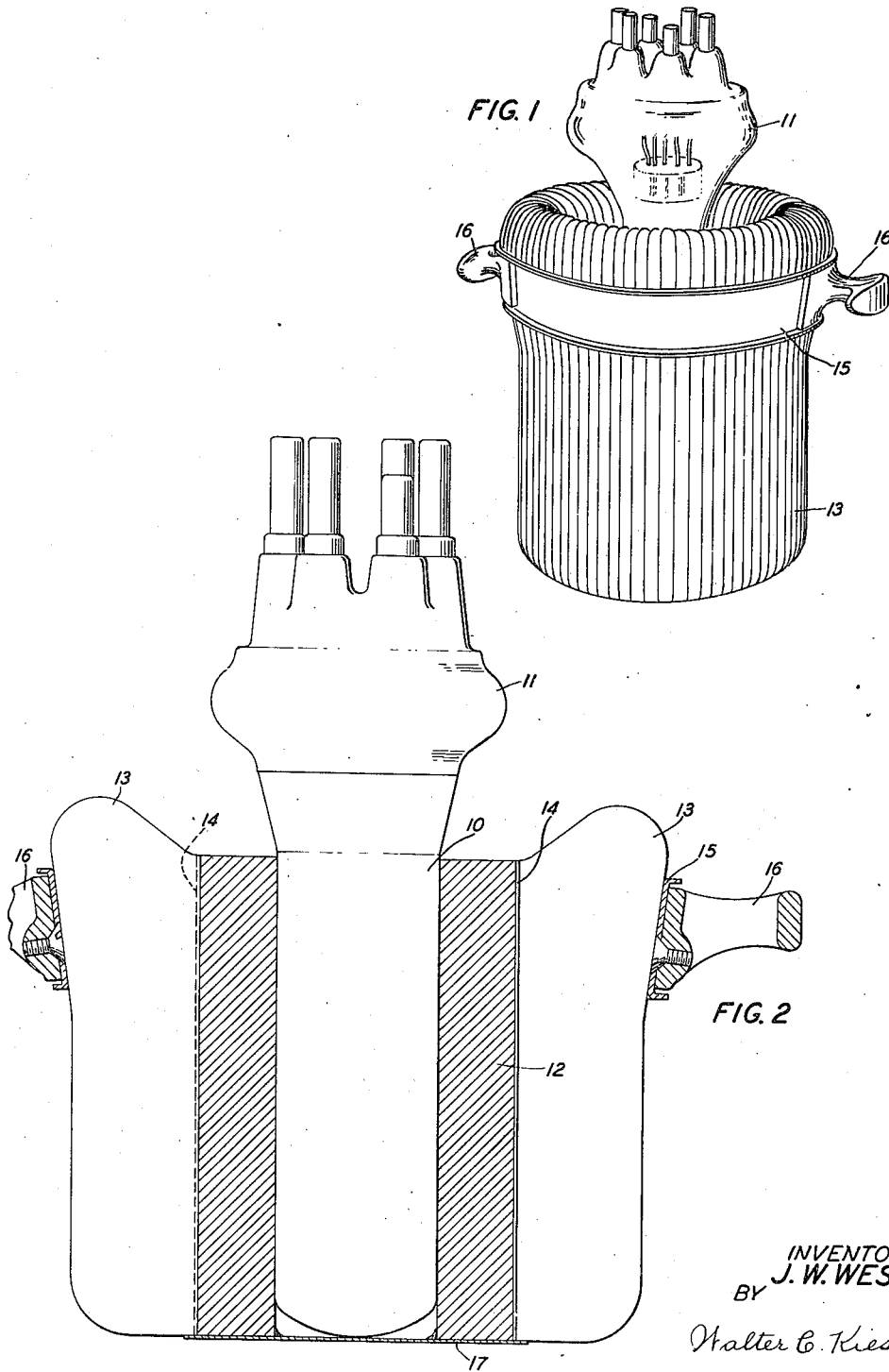
J. W. WEST

2,341,752

ELECTRON DISCHARGE DEVICE

Filed July 9, 1941

2 Sheets-Sheet 1



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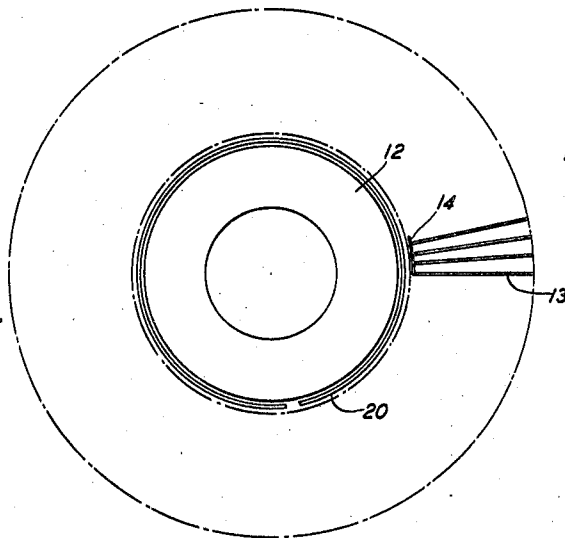


FIG. 3

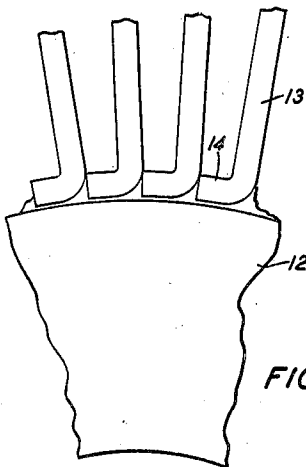


FIG. 5

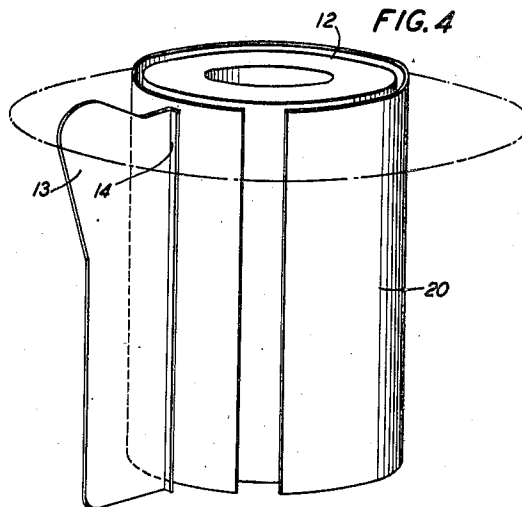


FIG. 4

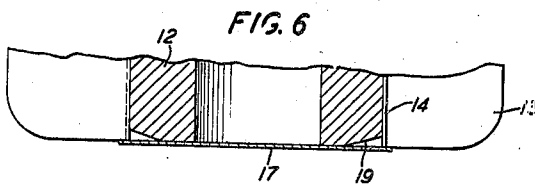


FIG. 6

INVENTOR
J. W. WEST
BY

Walter C. Kiesel
ATTORNEY

UNITED STATES PATENT OFFICE

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ELECTRON DISCHARGE DEVICE

John W. West, Woodside, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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6 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices and more particularly to such devices capable of handling large amounts of power.

The conventional high power discharge device, of 5 kilowatt or more capacity, includes an external cup-shaped copper anode which forms part of the enclosing vessel surrounding several cooperating electrodes and the heat generated in the anode is dissipated by cooling with a circulating medium, such as water or air. When air is employed the heat dissipation efficiency is increased by distributing radiating fins about the anode to more readily conduct the heat energy from the anode. Various manufacturing difficulties have heretofore been entailed in the constructional fabrication of such devices and particularly with methods of affixing the radiating fins to the anode. For instance, one method involves milling longitudinal slots in a sleeve member surrounding the anode and locating the fins in the slots by a soldering operation. This method is satisfactory when the number of fins is small and the cost of fabrication is moderate. However, when the number of fins is increased three or four fold the manufacturing cost becomes prohibitive and the radiation efficiency is impeded by large masses of low heat conduction metal between the sleeve and the fins which impede the conduction of heat away from the anode.

An object of this invention is to facilitate the dissipation of heat from the anode of electron discharge devices by radiation in an efficient and economical manner.

Another object of the invention is to fabricate a heat radiator for high power discharge devices whereby the radiation efficiency is increased.

A further object of this invention is to avoid the provision of milled slots for seating the radiating fins in the anode assembly.

These objects are attained in accordance with one aspect of the invention in which radially disposed heat radiating fins or conducting members are affixed to a copper sleeve surrounding an anode of an electron discharge device by brazing bent portions of the fins directly to the outer surface of the sleeve. This arrangement eliminates the slot milling operation and materially decreases the cost of the final product and the manufacturing technique and also increases the radiation efficiency of the device due to the excellent heat transfer relation between the sleeve and the fins.

A feature of the invention relates to a method

of assembly in which the sleeve is surrounded by a layer of fusible metal foil, such as solder of the required melting point, and the radiating fins are distributed around the sleeve with the angular bent portions in contact with the coil. The assembly is placed in an oven under suitable brazing conditions to melt the foil and rigidly secure the fins to the sleeve with a minimum of low heat conducting metal between the sleeve and the fins. A particular advantage of this method of assembly is the simultaneous fusing of all the fins to the sleeve in one operation thereby materially reducing the assembly time and cost in manufacture and definitely increasing the efficiency of radiation of heat.

Another feature of the invention relates to the fusing of the fins to the sleeve and preventing the excess fusible metal from clogging the lower edges of the fins during the brazing operation. This arrangement involves providing a bevel on the outer edge of the sleeve at one end and applying a cover plate over the sleeve adjacent the bevel, the plate also forming a seat for the inner edges of the fins. During the brazing operation any excess solder flowing to the bottom of the assembly will fill the bevel space thereby uniting the plate to the assembly and overcoming clogging of the fins with fusible metal.

These and other features of the invention will be more clearly understood from the following detailed description taken in connection with the accompanying drawings.

Fig. 1 is a perspective view of a complete high power air-cooled electron discharge device embodying the fin assembly of this invention.

Fig. 2 is a view in elevation of the device of Fig. 1 with the fin assembly shown in cross section.

Fig. 3 shows a plan view of the fin assembly illustrating the essential elements in their co-operating relation prior to the brazing operation.

Fig. 4 is a perspective exploded view of the anode sleeve with the foil wrapped about it and one of the fins in position, it being understood that the dotted line represents the diameter of all the fins positioned around the sleeve.

Fig. 5 is an enlarged fragmentary view of the fins brazed to a section of the sleeve; and,

Fig. 6 illustrates a partial view of the lower section of the fin assembly similar to Fig. 2, but modified to form a recess in the sleeve adjacent a cover plate at the bottom of the sleeve.

Referring to the drawings, the invention is applicable to a heat radiating assembly to be ap-

plied to an external cup-shaped copper anode 10 which forms part of the enclosing vessel of a high power electron discharge device 11. This device is usually mounted in operating position with the anode at the lower end of the assembly. The external anode is surrounded by a copper cylindrical block or sleeve 12. A plurality of thin copper radiating fins 13 are disposed equally about the sleeve, each fin being provided with a longitudinal angular or bent portion 14 adjacent the sleeve 12, which is brazed or soldered to the sleeve in good heat conducting relation, in order to readily dissipate the heat generated in the anode during operation. The fins are given an upwardly curved contour at the top of the sleeve to extend beyond the end of the sleeve and the width of the fin increases adjacent the top curved contour to provide a wedging seat for a collar or band 15 which surrounds the fin assembly, the collar being suitably secured to the fins by soldering. A pair of handles 16 are fastened to the band in diametrically opposed relation to permit handling of the unit for installation and replacement in a mounting. A cover plate 17 is attached to the lower surface of the sleeve 12 by solder and also to the conjoint surfaces of the sleeve and the fins, the plate forming a limit stop for the fins at the bottom of the sleeve. The sleeve may also be provided with a bevel 19, as shown in Fig. 6, to form a recess which is filled by flowing solder to affix the cover plate to the sleeve and in order to prevent the excess solder from clogging the radiating area of the lower portions of the fins.

In order to expeditiously secure a large number of fins to the sleeve in accordance with this invention, a method of assembly is utilized whereby all the fins are soldered or brazed to the sleeve simultaneously and in addition the cover plate is secured to the sleeve to facilitate the fabrication. This is accomplished by placing a fusible foil wrapper 20, of .005" thickness, in the form of a sheet or ribbon, of a silver solder alloy having a melting point from 700° to 800° centigrade, in embracing contact with the copper sleeve 12 and mounting all the fins in position with their bent portions 14 abutting the foil and the edge of each portion 14 abutting against the adjacent radial fin surface. In this manner 120 fins of .050" thickness may be accommodate on a 4" diameter sleeve, each fin having a bent portion of .100" width. The fins and cover plate may be held in assembled relation to the sleeve by a suitable jig prior to the brazing operation.

The assembled radiator is placed in an oven and heated to a temperature from 700° to 800° centigrade to melt the solder foil 20 and sweat or braze the fins to the sleeve, as shown in Fig. 5. The abutting relation of the flange portions 14 to adjacent fins together with the solder filler materially reinforces the support of the fins on the sleeve 12. The excess solder may flow into the beveled recess 19 to affix the cover plate 17 to the sleeve and also prevent clogging of the spaces between the lower edges of the fins. The completed radiator may be slipped over the anode and soldered thereto with a lower melting point solder or the anode and fin assembly may be simultaneously soldered to the sleeve in one brazing operation.

This method of assembly materially decreases the manufacturing and fabrication costs since the fins are affixed to the sleeve simultaneously, expensive milling of slots for the fins is avoided, and the number of fins can be increased 30 to 60 per

cent over previous constructions thereby facilitating the heat radiation efficiency of the assembly. Furthermore, a minimum amount of low heat conducting metal is provided between the fins and the sleeve by this assembly so that the fins are in excellent heat transfer relation to the sleeve which is in contact with the anode of the discharge device.

While the invention is disclosed with respect to a particular embodiment and method of assembly, it is, of course, understood that various modifications may be made in the detailed construction and method without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. An air-cooled heat radiator for external anode discharge devices comprising a hollow heat transfer member of large mass having an outer smooth surface, and a plurality of radial metallic fins distributed about said surface having longitudinal inner bent extensions adjacent said surface and separated therefrom by a thin film of fusible metal.
2. An air-cooled heat radiator for external anode discharge devices comprising a hollow heat transfer member of large mass having an outer smooth surface, a plurality of elongated radial metallic fins distributed about said surface having inner bent extensions adjacent said surface and separated therefrom by a fusible metal, and a cover member on one end of said hollow member having a peripheral portion abutting against said fins.
3. An air-cooled heat radiator for external anode discharge devices comprising a hollow heat transfer member of large surface, a plurality of radial metallic fins distributed about said surface having inner flange portions adjacent said surface and separated therefrom by fusible metal, a cover member on one end of said hollow member, said hollow member having a beveled edge at one end, and a metallic filler in the beveled space defined by said member, said fins and said cover plate.
4. An air-cooled heat radiator for external anode discharge devices comprising a metallic sleeve member of large mass surrounding said anode, a plurality of elongated radial metallic fins distributed about said sleeve, said fins having inner bent extensions longitudinally adjacent said sleeve, and a thin film of soldering material between said sleeve and said extensions.
5. An external anode discharge device having a hollow cup-shaped anode, a metallic sleeve in heat transfer relation to said anode, and a plurality of elongated metallic fins radially distributed about said sleeve having inner bent extensions adjacent said sleeve and abutting the surface thereof, the adjacent surfaces of said extensions and sleeve having an adherence of fusible metal less than .005" thickness.
6. In combination, an electron discharge device having a cup-shaped external anode portion, a heat radiator therefor, comprising a metallic sleeve member of large mass, a plurality of metallic fins radially distributed about said sleeve member, each fin having a longitudinal flange portion abutting against the surface of said sleeve member, a thin film of fusible metal interposed between the flange portions of said fins and said surface, and a film of lower melting point metal interposed between said sleeve member and said anode portion.

JOHN W. WEST.