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C. V. LITTON

2,312,920

ANODE COOLING JACKET

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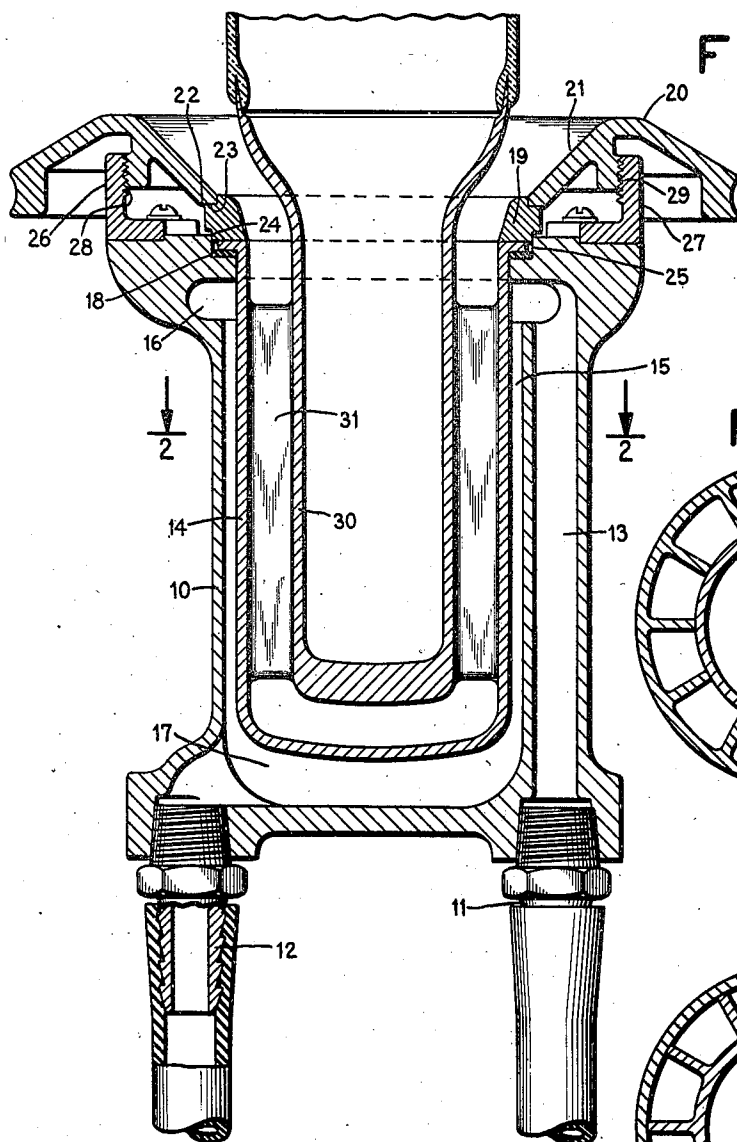


FIG. 1.

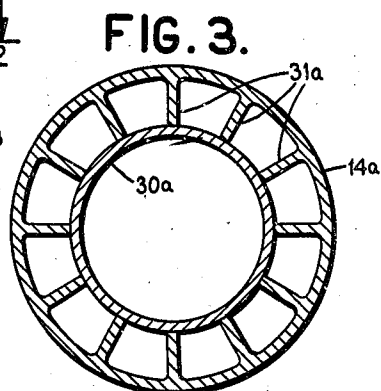


FIG. 3.

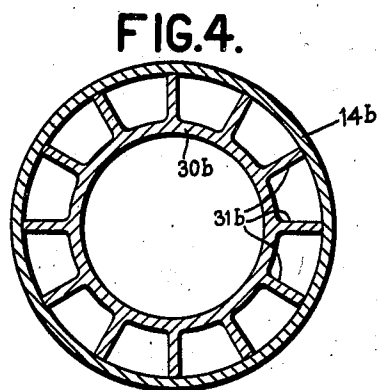


FIG. 4.

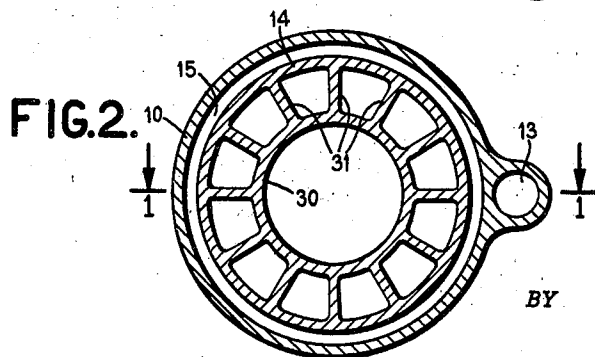


FIG. 2.

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ANODE COOLING JACKET

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4 Claims. (Cl. 250—27.5)

This invention relates to vacuum tube construction and particularly to temperature regulating means for vacuum tubes.

The object of the invention is to provide a construction by which the flow of heat from a hot anode to a cooling medium can be controlled.

There have been heretofore provided vacuum tubes of which the anodes are water cooled by means of a jacket around the anode, through which a cooling fluid flows to conduct heat away from the anode. It is sometimes desired that the anode be operated at a higher temperature than the available fluid jacket permits, as for example, when thoriated filaments are used in the tube; for in such tubes, if the anode were maintained too cool the thorium would condense on the anode. Or gas released by electrons might collect and stick there unless the anode be kept warm enough.

In accordance with my invention, there is provided an anode and jacket construction adapted to be placed into permanent cooling systems designed to operate at temperatures below the desired temperature, but which by use of the present invention can maintain the anode at the desired higher temperature. This higher temperature is maintained by means of a dummy anode which may be in the form of a wall or cylinder, adapted to be placed in the position of an ordinary anode adjacent the wall of the fluid jacket; and the real anode is placed within the dummy anode and joined to the dummy anode by the use of suitable heat conducting struts or webs. The number and the thickness and length of the webs determine the rate at which the heat is conducted from the real anode to the dummy anode, and consequently controls the temperature of the real anode above that of the cooling jacket.

In the drawing,

Fig. 1 is a longitudinal cross sectional view taken at line 1—1 of Fig. 2, of an anode cooling device arranged in a water-cooling jacket according to this invention; and

Fig. 2 is a cross sectional view of the device taken at line 2—2 of Fig. 1.

In the drawing, there is shown a fluid cooling jacket such as a water jacket of a general type which has theretofore been used, into which there is adapted to be placed the anode of a vacuum tube to be cooled. The jacket comprises a cylindrical member 10 having two water connection nipples 11 and 12 and a water inlet channel 13. There is placed within the jacket a dummy anode 14 which may be generally cylindrical in shape and spaced from the inner wall of

jacket 10 by a narrow annular space 15 which may be of the order of $\frac{1}{16}$ of an inch. The jacket is formed with a toroidal cavity 16 around the dummy anode at one end, and another cavity 17 at the opposite end, there being an annular gasket 18 between the end of the dummy anode and the jacket to prevent leakage of the cooling fluid. Thus, cooling fluid can pass from end of nipple 11 through inlet channel 13 to cavity 16 through space 16 to cavity 17 and out the exhaust nipple 12.

To clamp the dummy anode 14 into its position within the jacket, there is provided a known type of clamp arrangement somewhat similar to that illustrated in Suydam Patent 2,186,563, issued January 9, 1940. This comprises an annular ring 19 which is preferably a split ring of two or more sections, which rests against the open periphery of the dummy anode. To bind the ring 19 against the anode, there is provided a pressure collar 20 having an inwardly sloping annular portion 21 terminating in a pressure face 22 which engages with a circular recess 23 of ring sections 19. The opposite outer surface of ring 19 is chamfered at 24 to contain it within the periphery 25 of the jacket and permit free movement of the ring toward the main body of the jacket. Posts 26 and 27 are fastened to the end of the jacket and threaded at 28 and 29 respectively to receive the corresponding threads on pressure collar 20. Thus by turning the pressure collar, the ring 19 may be tightened down against the end surface of member 14 to compress it against gasket 18. By splitting the ring 19 into sections, the member 14 may be removed from the jacket simply by loosening collar 20 and then removing the sections of ring 19 from positions between the posts 26 and 27, as described in the above-mentioned Suydam Patent 2,186,563. The jacket as thus described is of a type widely used to receive the anode of a tube which is to be water cooled.

Ordinarily, when the present invention is not being used, the outer surface of a tube anode will occupy the position occupied by the member 14 of the drawing, and tubes may readily be introduced and taken from the jacket from time to time if desired. In accordance with this invention, the member 14 is not the real anode but is a dummy anode, the real anode being the member 30 placed within the dummy anode and supported by the latter by a number of webs 31. The heat of anode 30 is conducted through webs 31 to the dummy anode 14 from which it is conducted away by the flow of cooling water. Owing to the limited cross sectional area of heat con-

duction of the webs 31, the temperature of the real anode 30 is maintained higher than that of dummy anode 14 which is next to the cooling fluid. By the adjustment of the number, size and thickness of the webs 31, the real anode may be maintained at the desired temperature above that of the dummy anode.

Figs. 3 and 4 show possible modifications of the arrangement shown in Fig. 1. In Fig. 1, the anode 30, the fins 31 and the outer wall are shown formed in one piece. In Fig. 3, which is a cross section view of the anode, webs and wall corresponding to the same elements in Fig. 2, the anode 30a, corresponding to the portion 30 in Fig. 2, is shown in one piece and the webs 31a are shown integral with cylindrical wall 14a in another piece; the elements 31a and 14a corresponding respectively with the elements 31 and 14 in Fig. 2. In Fig. 4 a somewhat different modification is shown wherein the webs 31b, instead of being integral with the outer wall 14b as shown in Fig. 3, are integral with the anode 30b, and the wall 14b is a separate piece. Here, the parts 14b, 30b and 31b correspond respectively with the parts 14a, 30a and 31a in Fig. 3.

By the use of this invention, it is possible to place within existing jackets of an ordinary type, the anodes of tubes which must be maintained at a higher than ordinary temperature. Special types of tubes, such as those having thoriated filaments whose anodes should be maintained at higher than ordinary temperatures for efficient operation can accordingly be provided with the webbed jacket and placed within the same cool-

ing jackets as the regular anodes of ordinary tubes which can be operated cooler. The invention thus provides for the ready interchangeability of the anodes of different types of tubes within the same cooling jacket and system.

What is claimed is:

1. In combination, a vacuum tube anode, a wall around the anode and a jacket around the wall, said wall and jacket forming a chamber through which a cooling fluid is passed, and a web means connecting the anode and the wall, for conducting heat from the anode to the wall, said web means having a cross section and length in respect to the path of the heat flow proportioned to maintain the anode at a predetermined temperature above the temperature of the cooling fluid.

2. A combination according to claim 1 in which the web means are a plurality of webs extending radially between the anode and the wall.

3. A combination according to claim 1 in which the anode, the wall and the jacket are cylindrical in shape and concentrically arranged with respect to each other, and the web means are a plurality of webs extending radially between the anode and the wall.

4. In combination, an anode, an outer wall around the anode adapted to dissipate heat to a medium in contact with said wall, and a plurality of webs connecting the anode with the wall for conducting heat from the anode to the wall.

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