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J. W. CONKLIN ET AL
ELECTRON DISCHARGE APPARATUS

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Fig. 1.

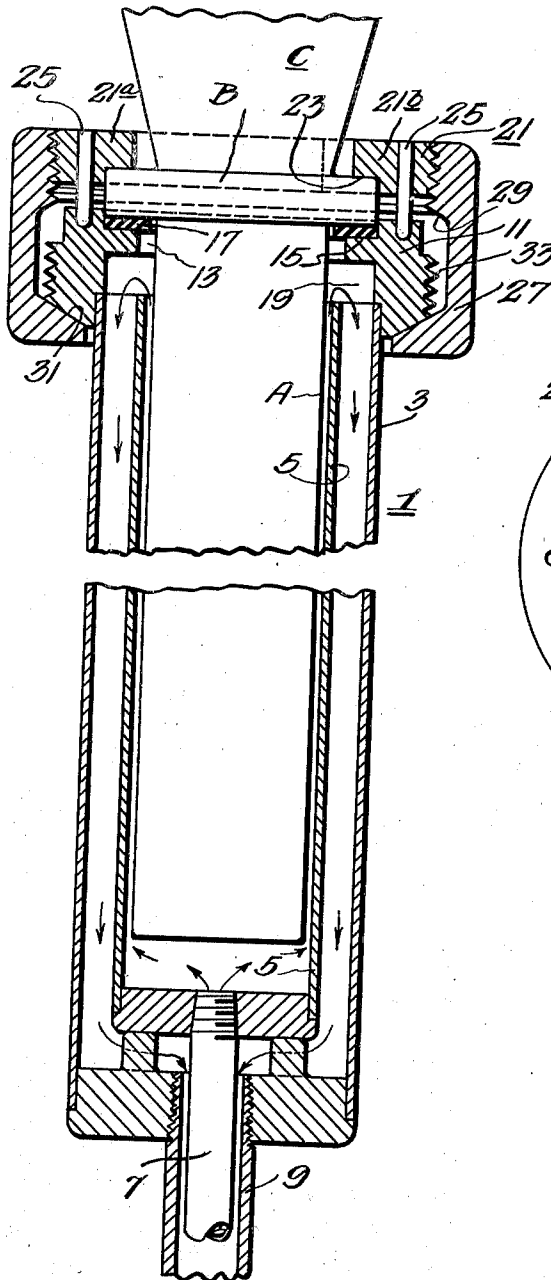
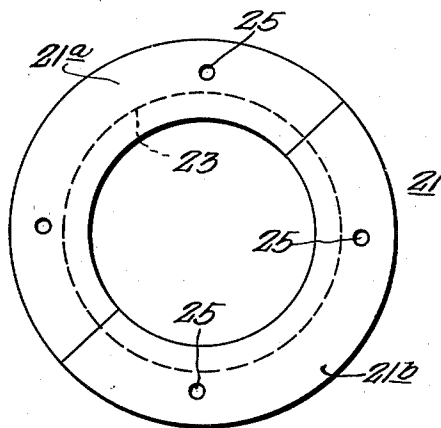


Fig. 2.



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ELECTRON DISCHARGE APPARATUS

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4 Claims. (Cl. 250—27.5)

This invention relates to electron discharge apparatus and particularly to electron discharge devices of the type employing a removable jacket through which a cooling fluid is circulated for the purpose of dissipating excess heat which is generated when the device is subjected to high operating potentials.

Discharge tubes of the type described comprise an evacuated container having a dependent metal wall which constitutes the anode or other tube element adjacent which the water or other cooling fluid is circulated.

One difficulty encountered in assembling and operating cooling arrangements of the type described is that of forming a fluid-tight seal between the discharge tube and its water jacket. Usually the tube is provided with an outwardly extending flange on its metal wall and the jacket is provided with a cooperating rim and gasket upon which the tube flange rests. Thumb screws, secured to the jacket, have heretofore been employed for exerting a clamping force to the assembly at a plurality of spaced points about the periphery of the rim and flange. The use of such screws has proven objectionable not only because of the difficulties incident to distributing the clamping force with the high degree of uniformity required to achieve and to maintain a fluid-tight seal but also because the screws constitute a plurality of point contacts upon which a spark discharge may originate when the device is operated at very high potentials. A more uniform fluid-tight seal may be achieved by the use of a plurality of rotary members for applying a rolling clamping-force to the tube flange, as disclosed in U. S. Patent 2,109,834, to Felix C. Blancha, but here, as in the case of set screws, the seal-maintaining force is exerted at spaced points, i. e., at the points upon the flange at which the rollers come to rest.

Another very real objection to prior art water-cooled discharge apparatus, which is especially pronounced at ultra high frequencies (say, within the present television broadcasting bands) is that the cooling jacket and its cap are of such contour and dimensions as to introduce undesired capacitance effects into the associated circuits.

Accordingly, the principal object of the present invention is to obviate the above-described and other less apparent disadvantages inherent in prior art fluid-cooled electron discharge devices.

Another object of the invention is to provide a simple, inexpensive, trouble-free, low-capacitance, fluid-tight, mechanical coupling between a discharge tube and its jacket and one which

may be attached and detached without subjecting the tube or its flange to any torque or twisting force.

Other objects and advantages, together with certain details of construction, will be apparent and the invention itself will be best understood by reference to the following description when read in connection with the accompanying drawing, wherein

Figure 1 is a view, partly in section and partly in elevation, of an electron discharge device provided with an improved water jacket and clamping device, and

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

In the drawing, 1 designates generally a jacket or receptacle for water or other cooling fluid within which the cylindrical metal anode portion A and outwardly extending circumferential flange B of an electron discharge tube C is inserted. The jacket 1 is preferably made of brass or other nonrusting, heat-conductive material and comprises an outer cylinder 3 and an inner cylinder 5 which surrounds the anode A and communicates with the outer cylinder adjacent the top. Water is supplied to the inner cylinder 5 by means of an inlet pipe 7 adjacent its base and is discharged through an outlet pipe 9 which communicates with the outer cylinder 3 and surrounds the inlet pipe through a portion of its length.

Intimately secured to the outer cylinder 3, adjacent its open end, as by a force fit or by brazing or welding, is a cap 11 having a central orifice 13 and a surrounding shoulder 15 which accommodates a gasket 17 upon which the anode flange B is seated. The underside of the cap 11 is cut away adjacent the open ends of the cylinders 3 and 5, as indicated at 19, to permit the passage of the cooling fluid from one cylinder to the other.

An externally threaded annulus which, as more clearly shown in Fig. 2, is in the form of a split ring 21, composed preferably of but two separable sections 21a, 21b, fits about the upper surface of the tube flange B; a shoulder 23 on the underside of the annulus ensures a snug fit about the flange. One or more projections or pins 25 in each of the parts 21a, 21b, of the annulus fit in complementary holes in the upper surface of the cap 11 and serve to prevent relative rotary movement therebetween when a clamping force is applied to the flange B through the annulus.

A collar 27, provided with two inwardly extending flanges or rims, 29, 31, respectively, sur-

rounds the cap 11 and annulus 21. The upper rim 29 is internally threaded to engage the threaded outer surface of the annulus. The lower rim 31 extends around the lower surface of the cap 11 so that, when the collar is screwed up, the inner wall of the rim 31 abuts against the said lower surface of the cap. Since the cap 11 is secured to the jacket 1, the upward movement of the collar 27 is limited and any torque which is applied thereto urges the annulus 21 downwardly with a positive unidirectional clamping force against the upper surface of tube flange B. As previously set forth, the pins 25 which project from the annulus 21 engage the cap 11 and prevent relative rotary movement therebetween when the collar 27 is turned.

It will be observed, upon inspection of Fig. 1, that a portion of the outer surface of the cap 11 is threaded and that this portion, which is designated 33, is threaded in the same manner as the outer surface of the annulus 21. These threads 33 facilitate the assembly of the various parts and serve to prevent the collar 27 from dropping off when it is unscrewed to permit the tube to be withdrawn from its jacket.

In assembling the device of the drawing, the collar 27 is fitted over the lower end of the jacket 1 and drawn upwardly into engagement with the threaded portion 33 of the cap 11. The collar is then turned until its threads pass completely over the threaded part 31. The anode A is then entered within the cooling cylinder 5 and the anode flange B seated on the gasket 17 which is contained within part 15 of the cap 11. The separate parts 21a, 21b of the split ring or annulus are then placed around the tube flange B with the pins 25 seated in the holes in the cap 11. The cap is then raised to engage the threaded outer surface of the annulus 21 and the cap screwed up. Since the annulus 21 engages the tube flange over the entire 360° of its surface (instead of at but a few points about its surface), it is apparent that a substantially perfect fluid-tight seal is achieved. It will be further apparent that this construction provides a compact assembly and one which ensures a continuous electrical contact with minimum mechanical distorting force on the anode flange B. As previously brought out, these latter features of the invention are of especial importance when the electron discharge device is employed in ultra high frequency work.

It will be apparent to those skilled in the art to which the invention appertains that various modifications may be made in the described construction without departing from the spirit and scope of the invention. It is to be understood, therefore, that the foregoing is to be interpreted as illustrative and not in a limiting sense except

as required by the prior art and by the spirit of the appended claims.

What is claimed is:

1. The combination with a discharge tube having a part to be cooled and an outwardly extending circumferential flange on said part, of a hollow fluid receptacle having a shoulder upon which a surface of said flange rests, an annulus adapted to be fitted about the opposite surface of said flange, means for applying a clamping force about the entire circumference of said tube flange through said annulus and means for preventing rotary movement of said annulus with respect to said flange upon the application of said clamping force.

2. A cooling jacket for electron discharge tubes of the type provided with an outwardly extending anode flange, said jacket comprising a part adapted to receive and support said flange, a split ring having separable parts adapted to be fitted about said tube in contact with a surface of said flange, means for applying a unidirectional clamping force to said tube flange through the separable parts of said split ring, and means for preventing rotary movement between said split ring and said flange-supporting part of said jacket upon the application of said clamping force.

3. The invention as set forth in claim 2 wherein the separable parts of said split ring are provided with projections which engage the flange supporting part of said jacket and serve to prevent relative rotary movement therebetween.

4. The combination with a discharge tube having a cylindrical metal wall and an outwardly extending flange thereon, of a hollow open-ended fluid receptacle adapted to receive said tube wall, an annular cap secured to and projecting outwardly from said receptacle adjacent the open end thereof, said cap being outwardly threaded and provided on one surface with a shoulder upon which said tube flange is received, a split ring comprising separable parts adapted to be fitted about said tube wall in contact with the opposite surface of said tube flange, the outside diameter of said ring corresponding to that of said annular cap and having similar threads, a collar about said receptacle, said collar having an inwardly threaded portion adapted to successively engage the threaded portions of said cap and ring and an inwardly projecting portion adapted to abut the underside of the projecting part of said cap when the threaded parts of said collar and ring are engaged, and means for preventing relative rotary movement between said cap and ring when said collar is turned.

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