Nov. 7, 1944. F. C. BLANCHA 2,362,044

COOLING SYSTEM

Filed Dec. 31, 1941

FIG. 1.

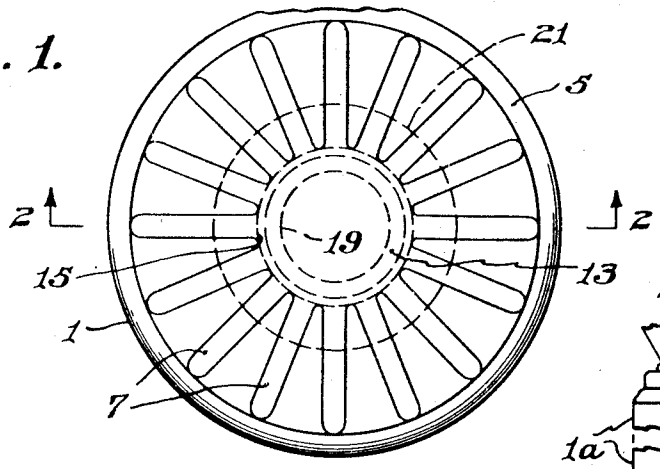


FIG. 3.

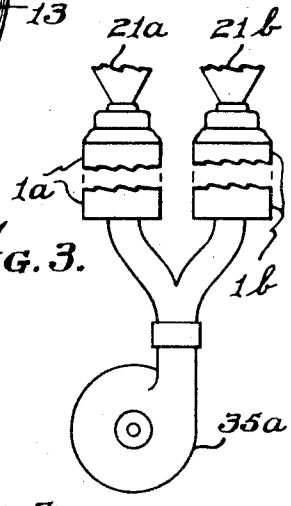
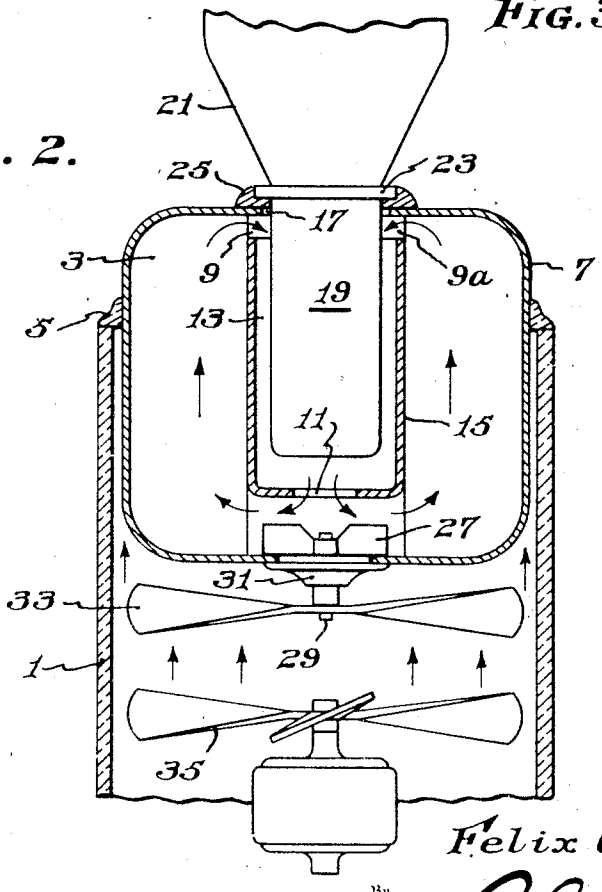


FIG. 2.



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COOLING SYSTEM

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4 Claims. (Cl. 250—27.5)

This invention relates to cooling systems and particularly to an improved method and means for dissipating excess heat generated during the operation of high-powered electron discharge devices of the type wherein the anode or other part to be cooled comprises a portion of the envelope of the device.

The usual cooling system for power tubes comprises a jacket (within which the tube is seated) having inlet and outlet ports which are connected as by means of metal and porcelain pipe or rubber hose to a remotely disposed radiator through which the water or other coolant is circulated by means of a pump. When, as is usually the case, the tube is operated at high voltages, the cooling path must be a very long one to provide a sufficiently high electrical resistance to prevent excessive losses of current. Such cooling systems are not only cumbersome and expensive but present a very real electrical hazard to those entrusted with their operation and repair.

Accordingly, the principal object of the present invention is to obviate the foregoing and other less apparent objections to present day cooling systems of the general character described.

The foregoing and other objects are achieved in accordance with the invention by immersing the tube part or other object to be cooled in a liquid coolant, directing a cooling stream of air on the outer surface of the receptacle in which the coolant is contained and causing said air stream to produce a circulation of the coolant adjacent said tube part. The circulation of the coolant adjacent the part to be cooled is preferably produced by a fluid-drive comprising an impeller fixed on the inner end of a shaft which extends through the bottom or other wall of the receptacle and driven by a propeller mounted in the path of the cooling stream of air. The air stream may be provided by a fan or turbine of any suitable or convenient type. The absence of any mechanical coupling between the driving and driven elements of the cooling system not only obviates mechanical vibrations which tend to set up microphonic disturbances in the tube but also obviates the danger of electrical shock normally present in conventional cooling systems for high-powered electrical apparatus.

Other objects and advantages, together with certain preferred details of construction, will be apparent and the invention itself will be best understood by reference to the following specification and to the accompanying drawing, wherein

Figure 1 is a top plan view and Figure 2 is a vertical sectional view, taken on the line 2—2 of Figure 1, of a cooling system within the invention and adapted for use with a high-powered electron discharge tube, and

Figure 3 is an elevational view of a duplex embodiment of the invention and showing an alternate type of blower.

In the drawing wherein like reference characters designate the same corresponding parts in all figures, 1 designates generally a vertically arranged hollow cylindrical pedestal or conduit constituted of porcelain, glass or other insulating material and within which a receptacle or vessel 3 for a fluid coolant is suspended as by means of an annulus 5 which rests upon or is clamped to the pedestal adjacent its upper open end. The fluid receptacle 3 may be made of copper, brass, or other non-rusting heat conductive material and is provided with a multiplicity of heat radiating surfaces which may be in the form of hollow fins 7 which extend radially outwardly from and communicate through ports 9, 9a and 11 with a central part 13 defined by a cylindrical baffle or jacket 15.

The top surface of the receptacle above the jacket 15 is provided with an opening 17 which is adapted to be closed and sealed upon the reception therein of the object to be cooled. The object to be cooled, in the instant case, comprises the cylindrical metal anode 19 of a high-powered electron discharge tube 21. The tube here shown is of a standard type and provided with a flange 23 which engages a suitable gasket 25 about the opening 17. A clamping arrangement such, for example, as the one shown in U. S. Patent 2,109,834 to Blancha or U. S. Patent 2,235,669 to Conklin et al., may be used for maintaining a fluid-tight seal between the flange 23 and gasket 25.

Motion is imparted to the coolant, preferably in the path indicated by the arrows, by means of an impeller 27 fixed on the inner end of a shaft 29 which extends through a suitable bushing 31 in the bottom wall of the receptacle in line with the opening 11 in the jacket or baffle 15.

The impeller 27 is driven by a propeller 33 which is fixed on the outer end of the shaft 29, within the conduit, and in the path of a stream of air from a fan 35 (Fig. 2) or turbine 35a (Fig. 3). This air stream, however generated, serves not only as a fluid drive for the impeller 27 but also as a cooling medium for the receptacle 3 containing the liquid coolant.

While the coolant in the receptacle 3 may comprise water, modern practice dictates the use of ethylene glycol or other liquid having a much

higher boiling point than water. The exact quantity of cooling fluid required will, of course, vary with the type and size of the object to be cooled. However, in this connection, it has been demonstrated that a cooling system constructed in accordance with the present invention and containing but from two to three quarts of liquid may be substituted without loss of cooling efficiency for prior art systems employing twenty gallons or more of the same coolant.

The invention lends itself to various modifications. By way of example, referring now to Fig. 3, a single blower or turbine **35***a* may be used for producing the necessary circulation of air for a duplex system comprising two conduits **1***a* and **1***b* for two separate tubes **2**1*a*, **2**1*b*, respectively. In some cases the impeller **27** and propeller **33** (shown in Fig. 2) may be omitted, in which case the circulation of the coolant within the receptacle **3** is dependent solely upon thermal convection.

Other modifications of the invention, such, for example, as the provision of alternate types and shapes of radiating surfaces for the hollow fins **3** of Figs. 1 and 2, will suggest themselves to those skilled in the art. It is to be understood, therefore, that the foregoing should 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. A cooling system for an electron discharge tube comprising an open receptacle for a coolant and adapted to be closed upon the reception therein of the part of said tube to be cooled, a rotatable shaft extending through a wall of said receptacle, an impeller fixed on said shaft within said receptacle for moving said coolant about said tube part, a propeller fixed on the exterior portion of said shaft, and means for producing a circulation of air adjacent said propeller whereby to drive said propeller and hence said shaft and impeller.

2. A cooling system for an electron discharge tube comprising an open receptacle for a coolant and adapted to be closed and sealed upon the reception therein of the part of said tube to be cooled, baffle means within said receptacle for directing said coolant in a predetermined path about said tube part, an impeller within said receptacle for imparting movement to said coolant along said path, means for producing a cooling stream of air about the exterior surface of said receptacle, and a propeller coupled in driving relation with said impeller and mounted in a position to be driven by said air stream.

3. A cooling system for an electron discharge tube of the type having a metal wall portion normally subjected to an operating potential of high intensity, said cooling system comprising a receptacle for a coolant and in which said tube portion is adapted to be seated, an insulating support comprising a conduit within which said receptacle is mounted, means for producing a cooling stream of air through said conduit and contiguous the outer surface of said receptacle, an impeller within said receptacle for imparting motion to said coolant, and a propeller for driving said impeller mounted exterior of said receptacle within said conduit and in the path of said air stream.

4. Method of cooling an electron discharge device having a part to be cooled, said method comprising immersing said tube part in a liquid coolant, directing a cooling stream of air on the outer surface of the receptacle in which said coolant is contained and causing said air stream to produce a circulation of said liquid coolant adjacent the said part to be cooled.

FELIX C. BLANCHA.