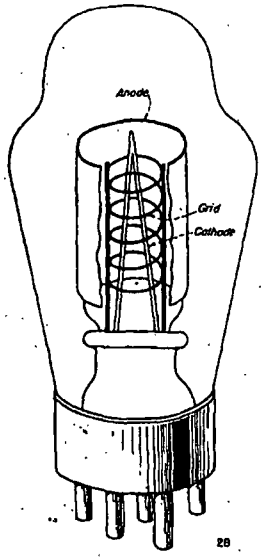
Electron-Tube and Mercury-Arc-Rectifier Constructions



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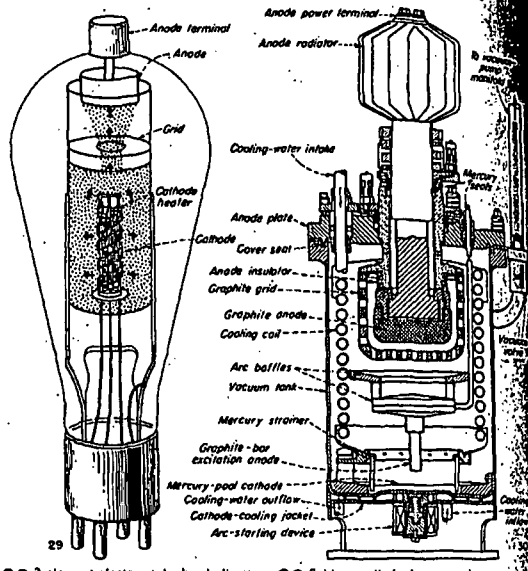
28 This 3-element high-vacuum tube has directly heated cathode, cylindrical metal anode and spiral wire grid



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29 3-element electron tube has indirectly heated metal ribbon cathode, dome-shaped anode and carbon-disk grid

30 Seldom called electron tubes, mercury-arc rectifiers operate on same principle as glass envelope tubes in 28, 29

ribbon spiral, Fig. 14 to 16. The heaters are tungsten or tungsten-molybdenum-alloy wire and the enclosing sleeve or spiral is a nickel alloy coated with an electron-emitting material. The heater is insulated from the sleeve and is used only to bring the sleeve and its coating to an electron-emitting temperature. Useful electron emission does not take place from the heater wire. One of the advantages of the heater-cathode design is that it permits close spacing between cathode and anode. Directly heated cathodes heat more quickly than indirectly heated ones and are used where quick heating is needed. When cathodes are indirectly heated a much larger electron-emitting surface can be heated efficiently; consequently they are used for medium and large currents. Later we will discuss other means of liberating electrons from a cathode, as by a light beam in the photoelectric tube and an arc in the mercury-arc rectifier.

Anode Material. Every electronic tube has an electron-producing element, just described, and an electron-collecting element, known as the plate or anode. The earlier designs of anodes were in the form of a flat plate, Fig. 17. Frequently two plates were used in parallel, with the cathode between. Because of its form the electron-collecting element became known as the plate, and is frequently called that today even though anodes are generally cylindrical or oval in construction, Fig. 18 to 24.

To be satisfactory, an anode material must be reasonably easy to form into shapes, must retain its shape at operating temperatures, radiate heat readily so it operates at a reasonably low temperature, have a low gas content and be easily degassed when the vacuum is created in the tube. Tungsten was one of the first materials used for anodes. It has many of the qualities desirable for anode material but is difficult to fabricate into the shapes required for anodes in modern electron tubes and so is now little used for that purpose.

Heat-dissipating qualities of molybdenum are not the best, but its other characteristics make it a desirable anode material and it is quite extensively used. Roughing of its surface by carborundum blasting and the addition of fins, Fig. 19 and 20, improves the thermal qualities of anodes made of this material.

Graphite, another commonly used material for anodes, contains considerably more absorbed gas than some of the others. It is, however, readily degassed, has good heat-dissipating qualities, can be readily formed into modern anode shapes, and does not warp because of high temperature. Fig. 21 to 23 show forms of graphite anodes.

Nickel readily forms into anode shapes, but it has low heat-dissipating qualities. Treating the outside surface of these anodes to a thin layer of car-

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