June 30, 1936. T. J. HENRY ET AL 2,045,648

METAL RECTIFIER

Filed April 13, 1935

Fig. 1

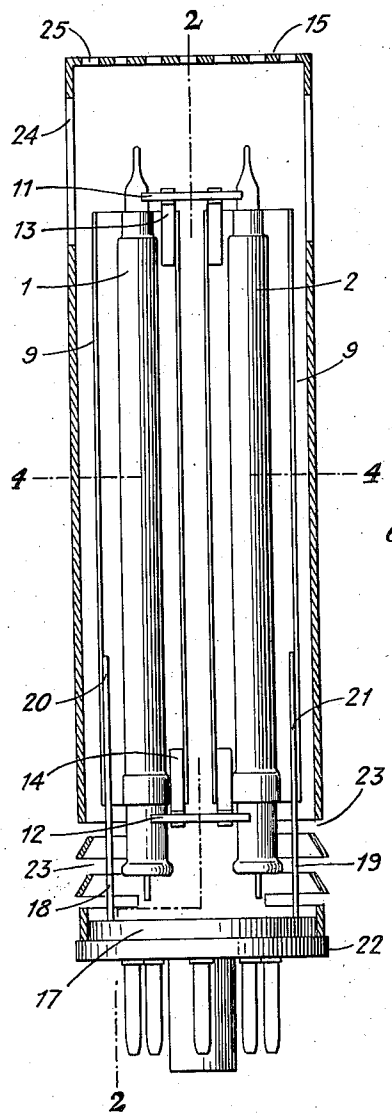


Fig. 2

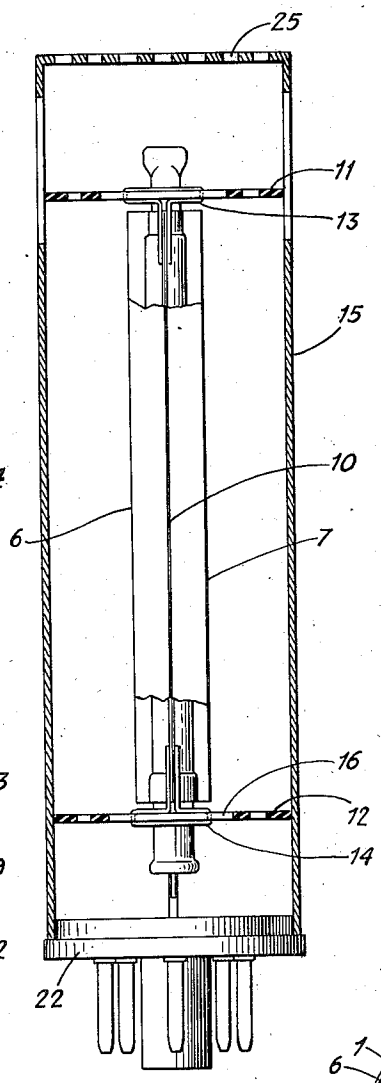


Fig. 3

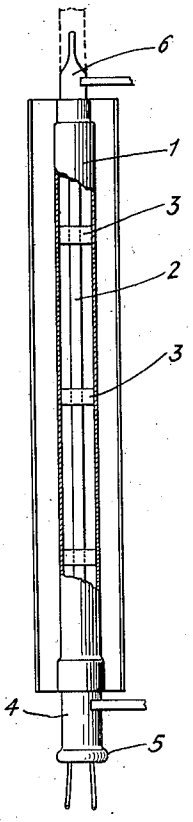


Fig. 4

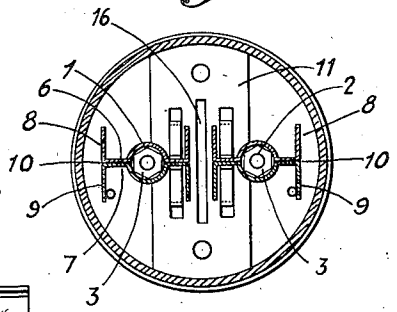


Fig. 5

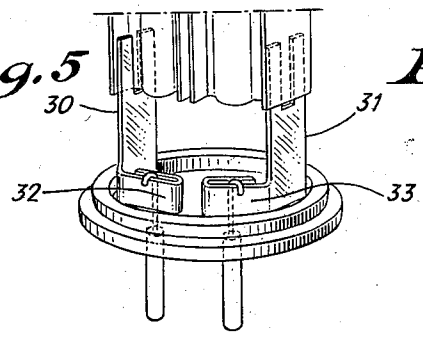
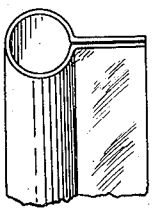


Fig. 6



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METAL RECTIFIER

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Application April 13, 1935, Serial No. 16,126

6 Claims. (Cl. 250—27.5)

Our invention relates to electron discharge devices of the all-metal type and more particularly to rectifiers with metal envelopes.

Electron discharge all-metal rectifiers of the all-metal type with a long or pencil-shaped metal cylinder of small diameter used as the anode as well as the envelope of the rectifier, have been suggested, but are apt to overheat when cooled by exposure only to the air, and are dangerous at high voltages if the high potential anode is exposed.

An object of our invention is to provide an efficient metal type rectifier of the air cooled type which will carry commercially desirable amounts of current without overheating.

A further object of our invention is the provision of a metal type rectifier inexpensive to manufacture, rugged in construction and with high potential exposed metal parts insulated and shielded.

A fuller understanding of our invention may be had by referring to the accompanying drawing in which Figure 1 shows an elevation of one form of our improved tube; Figure 2 shows a sectional view along lines 2—2 of Figure 1; Figure 3 is a cut-away view of one of the rectifier elements; Figure 4 is a section along lines 4—4 of Figure 1; Figure 5 is a detailed view of a modified form of the mount supporting means; and Figure 6 shows a slightly modified anode construction.

As best shown in Figure 3 the rectifier element comprises an oblong or pencil-shaped cylinder 1 of relatively great length and small diameter which in the embodiment illustrated functions as an envelope as well as an anode. Internally of the cylinder is a thermionic cathode 2, preferably of the indirectly heated type and having an elongated cylindrical sleeve positioned coaxial with the anode cylinder by insulating spacers 3, which preferably are polygonal in outline to reduce the contact area and heat conduction between the spacer and anode. The lower end of the anode cylinder is closed and the cathode is carried by a plug or stem, such as a metal sleeve 4, attached at one end, as by welding, to the inside of the anode cylinder, and carrying heater leads for the cathode, sealed into and insulated from sleeve 4 by a glass bead 5. At the upper end of the anode is a metal exhaust tube 6, thru which the envelope may be evacuated by an exhaust pump. The envelope may be evacuated to any desired degree of pressure and may be either highly evacuated or filled with gas at a low pressure. The exhaust tube 6 may be sealed off by pinching the tube together and then welding or brazing the tube walls at the pinch. Close spacing between the anode and cathode is obtained over an extended area of the cooperating surfaces of the anode and cathode, which results in low inter-electrode impedance with a correspondingly high current carrying capacity.

In one form of our invention the anode-envelope is constructed of two strips 6 and 7 of sheet metal pressed into the form best shown in transverse section in Figure 4. Each of the metal strips 6 and 7 is shaped, by pressing or by drawing in a die, into a sheet having two flat rectangular portions lying in one plane with an intermediate curved or semi-cylindrical portion as shown. The two shaped strips are placed face to face with the flat rectangular portions of the two strips adjoining each other and with the intermediate curved portions in registry to form an enclosure. The flat portions are then welded or brazed together to form a gas-tight joint between them throughout their length. The joined portions of the strips thus provide an extended sealing area between the strips as well as an effective heat radiator for cooling fins for the anode formed by the curved portions. Should a more extensive radiating surface be found desirable or necessary the flat portion of the metal strips 6 and 7 may be made wider and turned or bent outwardly beyond the joint as shown at 8 and 9. Such extensions provide considerable radiating surface in a minimum space.

As shown in Figure 6, the cylindrical anode may, if desired, be formed, from one sheet of metal and with only one welded joint, with a radial fin by rolling a single sheet of metal so that opposite edges of the sheet may lie parallel for sealing.

These forms of anode construction are characterized by the ease and accuracy with which the anodes may be manufactured to a given internal diameter as well as by the simple yet efficient arrangement of heat radiating fins.

As best shown in Figures 1 and 4, two rectifier units 1 and 2 are mounted side by side and are spaced apart top and bottom by insulating strip members 11 and 12 clamped to the units by straps 13 and 14. The ends of insulating members 11 and 12 are extended and so shaped as to fit inside a protecting shield or can 15, hereinafter more fully described. Strips 11 and 12 may be grooved, as shown at 16, to increase the length of the leakage paths between the two high potential anodes of the units 1 and 2.

The two rectifier units 1 and 2 are conveniently supported upon a base member 17 by support

rods 18 and 19, which are suitably secured as by welding or brazing to the cooling fins of the rectifier units, as best shown at 20 and 21. The lower ends of the supports 18 and 19 may be bent and inserted in the upper end of the tubular contact pins of the base, and thus serve both as supports and anode leads. The cathode heater leads of the two rectifier units may be connected in series or parallel as desired and connected to other pins in the base member.

To protect the parts of the rectifier from damage as well as to enclose the high voltage units 1 and 2, the shell or cup-shaped sleeve member 15 is lowered over the mount assembly and suitably secured at its lower end to the base. The base as shown is formed with a flange or ledge 22 against which the lower end of the enclosing shell 15 may abut. Enclosing shell 15 is preferably perforated to allow the free circulation of air about the radiating fins of the rectifier units. The ventilation ducts of the shielding can 15 may take any desired form such as uniformly spaced perforations over the side walls and top of the shell. Or, louvres and openings may be stamped out in the side walls and top of the can, as shown at 23, 24, 25, their position being chosen to promote the natural circulation of air along the radiating fins. With openings at the top and bottom, as shown, a natural draft or "chimney effect" may be obtained.

In the modification shown in Figure 5 a second form of electrode mount supporting means is shown. Strap members 30, 31 are split at their upper ends to permit their welding or brazing to the inner surface of the lower ends of the radiating fins. At the lower end of the straps are formed integral extensions 32, 33, which are bent to be welded or otherwise suitably secured to base pins in the base member. In this construction the wide footing of the supporting straps upon the base member affords rigid lateral support for the mount assembly.

It will be obvious to those skilled in the art that many modifications may be made in our device without departing from the scope of the invention. It is accordingly desired that our invention be limited only by the prior art and by the accompanying claims.

We claim:

1. An electron discharge device comprising an anode comprising an elongated metallic cylinder sealed in a gas-tight manner at its ends, an electron emitting cathode positioned interiorly of said cylinder, a base member with contact pins, means for supporting said anode upon and substantially normal to the plane of said base member, and protecting means for said anode comprising a perforate sleeve at least as long as said anode fitted over said anode and secured at one end to said base member and held in spaced relation to said anode by an insulating spacer member.

2. An electron discharge device comprising two envelope units each comprising a hermetically sealed length of metal tubing containing an electron emitting electrode, insulating spacers at each end of said units for securing said units in fixed parallel spaced relation, a base with contact pins, means for supporting said units upon said base, a perforated shell positioned over said units in engagement with said insulating spacers and secured at one end to said base, and electrical connections between each of said metal tubings and contact pins in said base.

3. In combination, an anode electrode comprising an upright elongated gas-tight metal container, an electron emitting cathode insulatingly supported within said anode and connected with current leads sealed in a gas-tight manner in the lower end of said container, a base with contact pins supporting said anode electrode, a shield comprising a sleeve positioned over and insulatingly spaced from said anode electrode and secured to said base, said shield being perforated adjacent each end of the container to induce the circulation of air about said container, and electrical connections between said contact pins and the anode electrode and the cathode current leads.

4. A rectifier comprising a pencil-shaped anode-envelope comprising two elongated strips of metal each with a longitudinal groove joined with the grooves in registry by a gas-tight seal along the edges of said grooves, the portions of said strips outward from said seal being bent at an angle to a plane thru the center line of said envelope to form heat radiating fins, an electron emitting electrode insulatingly supported within the enclosure formed by said grooved strips, means engaging the anode at each end of the enclosure to hermetically seal the enclosure, and current leads to said electrode insulatingly sealed in said envelope.

5. An electron discharge device comprising an evacuated sheet metal envelope comprising two similar sheet metal members each with two parallel flat portions lying in the same plane and an intermediate curved portion offset from said plane, the flat portions of each member adjoining the flat portions of the other member with the intermediate portions of said members in registry to form an enclosure, said flat portions adjacent the curved portion being joined gas tight throughout their length, and edge portions outward from the gas tight joint to serve as heat radiators, a thermionic cathode mounted coaxially within the envelope and cathode leads insulatingly sealed thru a glass bead in one end of said envelope and an exhaust tube sealed in the other end of said envelope.

6. An evacuated envelope for an electron discharge device comprising two similar sheet metal members each with two flat rectangular portions in one plane and an intermediate semi-cylindrical portion, the flat rectangular portions of each member adjoining the corresponding flat portions of the other member with the intermediate portions of said members in registry to form an enclosure, said flat portions being joined gas tight throughout their length, a cathode centrally supported in the envelope and an insulating plug in one end of said envelope containing leads for said cathode, a metal exhaust tube fitted into the other end of said envelope and supporting means for said envelope.

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