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V. L. RONCI

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ELECTRONIC DISCHARGE DEVICE

Filed May 2, 1935

FIG. 1

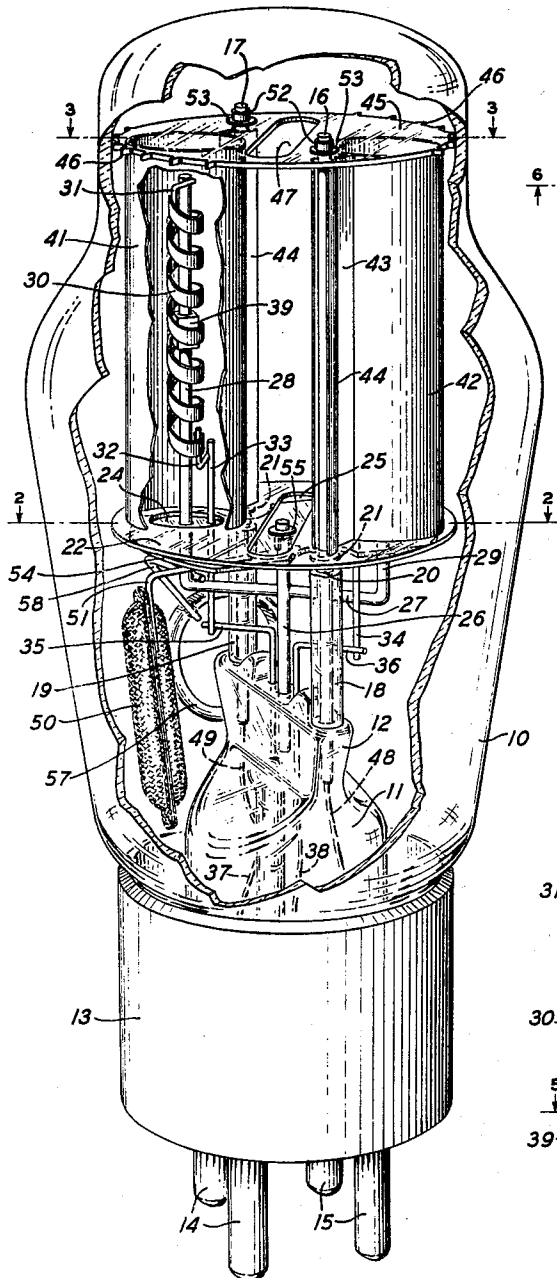


FIG. 2

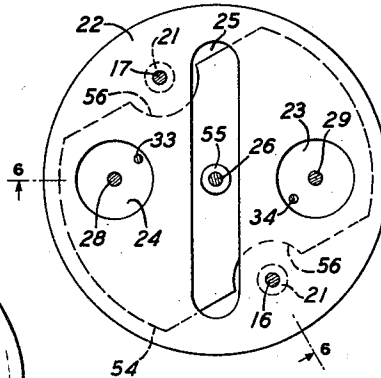


FIG. 3

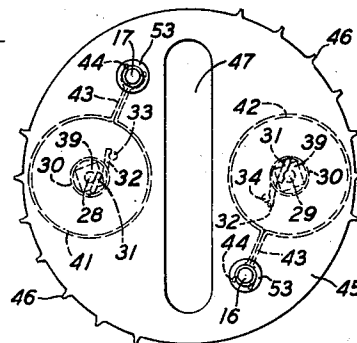


FIG. 4

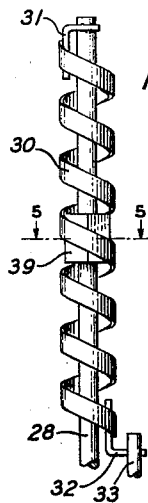


FIG. 5

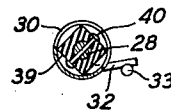
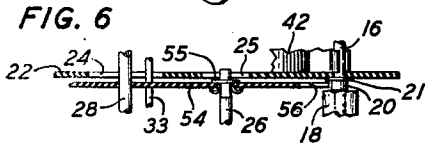


FIG. 6



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ELECTRONIC DISCHARGE DEVICE

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16 Claims. (Cl. 250—27.5)

This invention relates to electronic discharge devices and more particularly to devices of the full wave rectifier type.

An object of the invention is to maintain the operating characteristics of the device stable.

Another object of the invention is to unify the dual sets of elements in a compact and easily assembled structure.

A further object of the invention is to protect the electron emitters from destructive positive ionization.

In accordance with this invention a full wave rectifier comprises a vessel containing a material, such as mercury, to serve as a conducting vapor and the vessel is provided with a stem from which two parallel rods extend to support a pair of cylindrical anodes in parallel relation which are arranged in an offset position with respect to the stem. A spacer disc is attached to the parallel rods at one end and extends to the wall of the vessel to prevent shocks or vibrations changing the relative positions of the anodes and is fitted closely over the upper ends of the anodes to prevent the egress of electrons. A similar spacer disc substantially closes the lower ends of the anodes and is provided with apertures coaxial with the separate anodes to permit the passage of supporting members for the electron emitting cathode sections which are enclosed within the anodes. This arrangement facilitates the assembly of the individual rectifier units and provides a maximum degree of insulation resistance between the electrodes for the unitary assembly.

A feature of the invention relates to the confinement of the electrons emitted by the cathode sections to the limited area of the anodes to prevent arcing and breakdown. This is accomplished by supporting an auxiliary disc or shield adjacent the lower spacer disc, to mask the apertures through which the cathode supports extend. The auxiliary disc aids in maintaining the cathode sections coaxially within the anodes and also increases the insulation paths between the cathode sections and the anodes. Furthermore, the masking disc aids in registering the connections for the cathodes to overcome the effects of shocks or vibrations altering the relationship of the cathode structures with respect to the anodes. The close spacing of the masking disc to the lower spacer disc forms a minute gap which serves as an obstructing barrier to the passage of ionizing particles of mercury into the discharge path but permits the flow of ionizing vapor to reduce the internal impedance of the discharge paths between the cathodes and anodes.

Other features will be set forth in the detailed description relating to the embodiment of the invention as illustrated in the accompanying drawing, in which:

Fig. 1 is a perspective view of a complete assembly of the invention with a portion of the enclosing vessel and one of the anodes broken away to show the assembly of the elements and the relation of the cathode to the anode;

Fig. 2 shows a plan view of the lower insulating discs taken on the lines 2—2 of Fig. 1 looking in a direction towards the stem and the relationship of the supports extending from the stem;

Fig. 3 shows a plan view of the electrode assembly taken on the line 3—3 of Fig. 1 and illustrating the coaxial arrangement of the electrodes and the symmetrical formation of the anodes;

Fig. 4 is an enlarged view in elevation of the cathode assembly, while

Fig. 5 shows a cross-section of the cathode assembly taken on the line 5—5 of Fig. 4; and

Fig. 6 is a cross-sectional view of the lower insulating discs taken on the line 6—6 of Fig. 2 together with portions of the supports associated with the discs.

Referring to Fig. 1 of the drawing, the embodiment of the invention concerns a full wave mercury rectifier comprising an enclosing vessel 10 of glass having an inwardly projecting stem 11 terminating in a flat press 12. The stem-end of the vessel is seated in a tubular base 13 of insulating material having two pairs of contact pins or prongs 14 and 15 extending from the lower surface.

A pair of parallel upright supports or rods 16 and 17 are secured in the opposite ends of the press 12 and are surrounded by short glass sleeves 18 and 19 along the length thereof adjacent the press 12. These sleeves increase the insulation paths between the separate anodes of the device so that the limited length of the top of the press is increased three-fold. The glass sleeves may be held in place by being assembled with the upright rods 16 and 17 and fused into the glass of the press 12 during the sealing of the rods. Another method of holding the glass sleeves in position to prevent shaking and vibration is to assemble the glass sleeves on the rods after the sealing operation and then affix metallic eyelets 20 to the rods 16 and 17 above the glass sleeves 18 and 19. The metallic eyelets are provided with a flat flanged portion 21 which forms a seat for an insulating spacer disc 22, preferably of mica. The spacer disc 22 is provided with two punched holes which register with the upright supports 16

and 17 so that the disc 22 may be seated on the flanged portions 21 of the metallic eyelets 20. The spacer disc 22 is also provided with two large circular apertures or openings 23 and 24 having
 5 their centers on opposite sides and equal distances from the axis of the disc 22 and approximately at a 60 degree angle from a line passing through the upright supports 16 and 17 in the press. An elongated slot 25 extends across the
 10 disc 22 at right angles to a line passing through the centers of the large openings 23 and 24.

A central support rod 26 is sealed in the press 12 and extends up to the level of the spacer disc 22 and carries a U-shaped member which forms
 15 the main supporting structure of the cathode sections. This member consists of a cross piece 27 which is welded at the center to the support rod 26 and at the ends is formed with upright arms 28 and 29 which extend through the large
 20 apertures in the spacer disc 22. Each of the arms of the U-shaped member supports an electron emitting cathode section, such as a spiral ribbon 30, although other configurations of the cathode sections may be employed in this invention. The
 25 cathode sections may be formed of nickel ribbon, wire mesh ribbon or other suitable materials, to serve as a base for an electron emitting coating applied thereto which is usually the oxides of alkaline earth metals, such as barium and strontium oxides. Each cathode section which is pre-
 30 formed in a spiral and placed around the supporting arm of the U-shaped member may be secured in position by attaching the upper end to a bent stub wire 31 which is welded to the top of the arm, such as 28 or 29 of the U-shaped member. The lower end of the cathode section is secured to a similar shaped stub wire 32 which is welded to straight conductors 33 and 34 which
 35 extend through the large diameter apertures in the spacer disc 22 parallel to the arms 28 and 29. The lower ends of the straight wires 33 and 34 are attached to angular wires 35 and 36 which are sealed in the press 12. The angular wires are connected in the stem to leading-in wires
 40 37 and 38 which are joined to the contact pins 14 on the base 13 to supply heating current to the cathode sections in series. A rectangular insulating block 39 is positioned on each arm of the U-shaped member intermediate the ends of the cathode section and is secured to the arm by a
 45 pin 40. The edges of the insulating block engage the inner surfaces of the mid-point of the spiral cathode section to maintain the configuration of the cathode uniformly concentric with the arm supporting it and due to the limited contact between the cathode section and the block there is practically no loss in the uniform temperature of the cathode along its whole length because of conduction to the insulating spacer
 50 block.

The parallel cathode sections are surrounded by two concentric anodes 41 and 42 formed of sheet metal, such as nickel, and carbonized to dissipate the heat more readily. Each anode is formed of
 65 a cylindrical portion having the ends joined together in a flange 43 which terminates in a grooved portion 44. The grooved end portion 44 forms a receptacle or flute which embraces the length of the support rods 16 and 17 above the insulating disc 22 and is welded thereto to rigidly fasten the anode to the supporting rod. The cylindrical bodies of the anodes are placed in an offset position with respect to a plane passing through the stem so that the flanges 43 are

in opposed tangential relation with respect to the stem, with the lower edges of the anode abutting against the insulating spacer disc 22 and enclosing the large sized apertures in the disc on one side thereof. This assembly forms a compact
 5 unit of the two cylindrical anodes but in view of the fact that the spacer disc 22 is provided with the elongated slot 25 the insulating path between the adjacent surfaces of the two anodes is increased and the surface resistance between the upright support rods 16 and 17 is also increased. An insulating disc 45 similar to the disc 22 is fitted over the upright supports 16 and 17 and abuts against the upper edges of the anodes 41 and 42 to completely close the upper ends of the
 10 anodes and prevent the escape of electrons to the surrounding conducting vapor in the vessel. The upper insulating disc 45 is provided with serrated teeth 46 along two opposed quarter sections of the disc and these teeth engage the cylindrical inner wall of the bell portion of the vessel 10 as shown in Fig. 1. The upper disc 45 is also provided with an elongated slot 47 to increase the insulating path between the adjacent anodes and the respective upright supports for the anodes similar to the slot in the lower insulating spacer disc.

The full wave or dual rectifier device of this invention preferably employs an ionizing medium, such as mercury vapor to insure a low anode-cathode potential drop which is substantially independent of the anode potentials which are applied to the anodes from a suitable source connected to the terminal pins 15 on the base 13 which, in turn, are joined to leading-in wires 48 and 49 in the stem connected to the upright support rods 16 and 17, respectively, associated with the anodes. The mercury is initially introduced into the enclosing vessel 10 in a sealed glass capsule enclosed in the mesh wire container 50 which is supported by a wire 51 connected to the central supporting rod 26. The mercury is released from the capsule during the final processing of the device and when the cathode sections are heated to operating temperature the mercury is vaporized to serve as the ionizing medium between the cathodes and anodes. The upper insulating spacer disc 45 is secured in position against the upper edges of the anodes 41 and 42 by metallic eyelets 52, similar to the eyelets 20 below the insulating spacer disc 22. These eyelets have a sleeve portion welded to the upright support rods 16 and 17, respectively, and a flanged portion 53 which maintains the upper disc 45 against the top of the groove portions 44 and flange portions 43 of the anodes.

It will be realized that the discharge paths between the cathode sections and the inner surfaces of the anodes are completely confined except for the large apertures 23 and 24 in the lower spacer disc 22 and in order to close these apertures a rectangular shaped insulating shield or baffle member 54 is supported below the lower insulating spacer disc 22 by a metallic eyelet 55 which secures the shield to the central support 26. The shield or baffle member 54 is positioned with its long diameter at right angles to the plane of the press 12 so that the shield substantially completely closes the apertures in the disc 22 and is out of contact with the support rods 16 and 17 by having the surfaces adjacent thereto undercut as shown at 56 in Fig. 2. The shield or baffle member is placed so close to the lower surface of the spacer disc 22, as shown in Fig. 6, that

the gap formed therebetween prevents the egress of electrons from the discharge paths between the electrodes and thereby prevents the establishment of arcs. The gap, however, permits the entrance of mercury vapor to serve as the ionizing medium between the electrodes. This arrangement confines the ionization to the immediate and limited space between the electrodes and allows an unusually high inverse peak voltage to be obtained in the device. A magnesium getter is supported in a ring 57 which is supported by a bent wire 58 attached to the U-shaped cathode supporting member. The shield or baffle member 54 also serves as a guide for the arms and conductors for the cathode sections to insure proper alignment and to overcome vibration thereof. The rugged assembly of the elements of the device insures freedom from mechanical failures during transportation or in operation and the compact and symmetrical assembly of the units provides a device which may be fabricated at low cost from a production standpoint.

While the invention has been described with respect to a mercury vapor full wave rectifier, it is of course understood that the invention is not limited to the particular embodiment shown since other dual assemblies may be derived from the teaching of this invention. Furthermore, the invention should not be limited to the specific details shown and described since it is obvious that various modifications may be made in the complete assembly without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A dual electrode unit device comprising a vessel having a stem, a pair of supports extending from said stem, a pair of transverse insulating plates spaced apart on said supports, one of said plates adjacent said stem having large diameter openings, a spaced shield substantially closing said openings, electrodes projecting from said stem and extending through said openings, and a pair of sheet metal enclosing elements coaxially surrounding said electrodes, said elements being secured to said supports and having their ends abutting against said plates.

2. A dual rectifier device comprising a vessel having a stem, a pair of supports extending from said stem, a pair of transverse insulating plates spaced apart on said supports, one of said plates adjacent said stem having large diameter openings, a pair of electron emitting cathodes positioned between said plates and having extensions passing through said large diameter openings, a pair of anodes surrounding said cathodes and enveloping said openings on one side of said plate, and a baffle member supported adjacent the other side of said plate to shield said openings.

3. A dual rectifier device comprising a vessel having a stem and containing an ionizing vapor producing substance, a pair of supports extending from said stem, a pair of transverse insulating plates spaced apart on said supports, one of said plates adjacent said stem having large diameter openings, a pair of cathodes positioned between said plates, supports for said cathodes extending through said large diameter openings, a pair of anodes surrounding said cathodes and having their ends abutting against said plates, and a baffle member screening the large diameter openings in said plate adjacent said stem, said baffle member being positioned between said supports but out of contact therewith and being so close to said plate that the gap forms an obstructing barrier to the passage of electrons, but permits

the flow of ionizing vapor into the discharge paths between the cathodes and anodes.

4. A full wave rectifier comprising an enclosing vessel having a stem, a pair of supports extending from said stem, a pair of cylindrical anodes attached individually to said supports, an upper disc and a lower disc abutting against the ends of said anodes, means secured to said supports maintaining said discs in contact with said anodes, said lower disc having large apertures coaxially positioned with respect to said anodes, a U-shaped member extending from said stem having arms projecting through said apertures within said anodes, a spiral cathode surrounding each arm and having one end secured to each corresponding arm, a pair of conductors arising from said stem one extending into each aperture and connected to the opposite end of each spiral cathode, and an insulating shield aligning said arms and said conductors and masking the apertures in said lower disc.

5. A full wave rectifier comprising an enclosing vessel having a stem, a pair of supports extending from said stem, a pair of cylindrical anodes attached individually to said supports, upper and lower insulating discs engaging said supports and abutting against the ends of said anodes, said lower disc having individual apertures leading into said anodes, a U-shaped member extending from said stem and having arms projecting through said apertures within said anodes, a cathode supported by each arm and having one end secured to the free end of the corresponding arm, a pair of conductors arising from said stem one extending into each aperture and connected to the opposite end of each cathode, and an insulating shield aligning said arms and said conductors and masking the apertures in said lower insulating disc.

6. A full wave rectifier comprising a vessel having a stem, a pair of supports extending from said stem, a pair of cylindrical anodes attached individually to said supports, upper and lower insulating discs carried by said supports and abutting against the ends of said anodes, said lower disc having apertures leading into said anodes, a U-shaped member having arms projecting through said apertures within said anodes, a cathode supported by each arm and having one end secured to the free end of the corresponding arm, a pair of conductors arising from said stem one extending into each aperture and connected to the opposite end of each cathode, a central support extending from said stem, and an insulating shield attached to said central support serving as a guide for said arms and said conductors and masking the apertures in said lower insulating disc.

7. A full wave rectifier comprising a vessel having a stem, a pair of supports extending from said stem, a pair of anodes individually carried by said supports, insulating spacer discs extending transversely between said supports and closing the ends of said anodes, one of said discs adjacent said stem having apertures arranged coaxially with respect to said anodes, supporting members extending through said apertures, a pair of cathode sections carried by said members, and means between said stem and the lower spacer disc shielding the apertures in said lower disc and maintaining the spacial relation of said supporting members.

8. A full wave rectifier comprising a vessel having a stem, a pair of supports extending from said stem, a pair of anodes individually carried by

said supports, insulating spacer discs extending transversely between said supports and closing the ends of said anodes, one of said discs adjacent said stem having apertures mounted coaxially with respect to said anodes, supporting members extending through said apertures, cathode sections carried by said members, a central support extending from said stem, and a shield supported thereby adjacent the apertures in said lower disc.

9. A full wave rectifier comprising a vessel having a stem, a pair of supports extending from said stem, a pair of anodes individually carried by said supports, upper and lower insulating spacer discs extending transversely between said supports and closing the ends of said anodes, said lower disc having apertures mounted coaxially with respect to said anodes, an electron emitting cathode enclosed within each anode and having terminations projecting toward said stem through the apertures in said lower disc, and a baffle member supported adjacent said lower disc to shield the apertures therein.

10. A full wave rectifier comprising a vessel having a stem, a pair of supports extending from said stem, a pair of anodes individually carried by said supports, insulating spacer discs extending transversely between said supports and closing the ends of said anodes, one of said discs adjacent said stem having apertures mounted coaxially with respect to said anodes, supporting members extending through said apertures from said stem, a pair of electron emitting cathodes enclosed within said anodes and carried by said supporting members, a central support extending from said stem, and an insulating shield supported thereby adjacent the apertures in the disc adjacent said stem.

11. A full wave rectifier comprising a vessel having a stem, a pair of supports extending from said stem, a pair of spacer discs mounted transversely on said supports, a pair of electron emitting cathodes mounted parallel between said discs, and a pair of tubular anodes surrounding said cathodes, each anode having a flanged portion secured to one of said supports, the flanged portions of both anodes projecting in opposed tangential directions on opposite sides of the vertical plane of said stem with the axes of said anodes in a plane intersecting the plane of said stem.

12. A full wave rectifier comprising a vessel containing mercury and having a stem, a pair of upright rods projecting from said stem, a pair of cylindrical anodes supported by said rods, insulating discs closing the ends of said anodes, said discs having a central elongated slot forming a gap between the surfaces of said anodes to lengthen the insulating paths between said rods, a central cathode enclosed within each anode, a support having parallel arms projecting through apertures in the lower disc supporting each central cathode, and a shield closing the apertures in said lower disc, said shield being out of contact with said upright rods.

13. A full wave rectifier comprising a vessel having a stem, a pair of supports extending from said stem, a pair of spaced discs transversely

mounted on said supports, one of said discs having enlarged openings, a pair of hollow anodes carried by said supports and having their ends abutting against said discs, means on said supports maintaining said discs against said anodes, a pair of cathodes individually projecting into said anodes through openings in one of said spaced discs, a support for said cathodes, and a shield closing said openings in said disc and carried by said support for said cathodes.

14. A full wave rectifier comprising an enclosing vessel having a stem, a pair of supports extending from said stem, upper and lower spacer discs transversely mounted on said supports, said lower disc having enlarged apertures, a pair of spiral cathodes positioned between said discs in parallel relation, arms extending through said apertures in said lower disc and supporting said cathodes, a shield below said lower disc situated across said apertures, and a pair of anodes extending from said supports, said anodes enclosing said cathodes and having their edges abutting against said upper and lower discs.

15. A full wave rectifier comprising an enclosing vessel containing a vaporizable material to serve as the ionizing conductor, a stem in said vessel, parallel supports extending from said stem, insulating sleeves surrounding said supports adjacent said stem, metallic eyelets secured to said supports having a sleeve portion abutting against said insulating sleeves and an outwardly flared flange portion, an insulating disc fitted over said supports and resting on the flanged portions of said eyelets, said disc having enlarged apertures offset with respect to the plane of said parallel supports and having a diagonal slot intermediate said enlarged apertures, a central support extending from said stem, a U-shaped member secured to said central support and having arms projecting through said apertures in said insulating disc, a rectangular insulating shield spaced closely adjacent said disc having guide holes for registering said arms, an electron emitting cathode supported by each arm, a cylindrical anode coaxially surrounding each cathode with its lower end engaging said insulating disc around each aperture therein, each anode being affixed to a corresponding parallel support extending from said stem, a top insulating disc fitted over said parallel supports and seated on the top edges of said anodes, and other metallic eyelets having flange portions abutting against said top disc and secured to said parallel supports.

16. A dual rectifier device comprising a vessel having a stem, a pair of supports extending from said stem, a pair of anodes individually attached to said supports, closing means at opposite ends of said anodes, one of said means having apertures, a U-shaped support arising from said stem and projecting through said apertures, separate cathode sections carried by said U-shaped support and enclosed in said anodes, conductors for said cathode sections extending through said apertures, and an insulating shield aligning said U-shaped support and said conductors and masking the apertures in said closing means.

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