Sept. 4, 1928.

1,683,156

H. D. BROWN

ELECTRIC DISCHARGE DEVICE

Filed June 3, 1925

Fig. 1

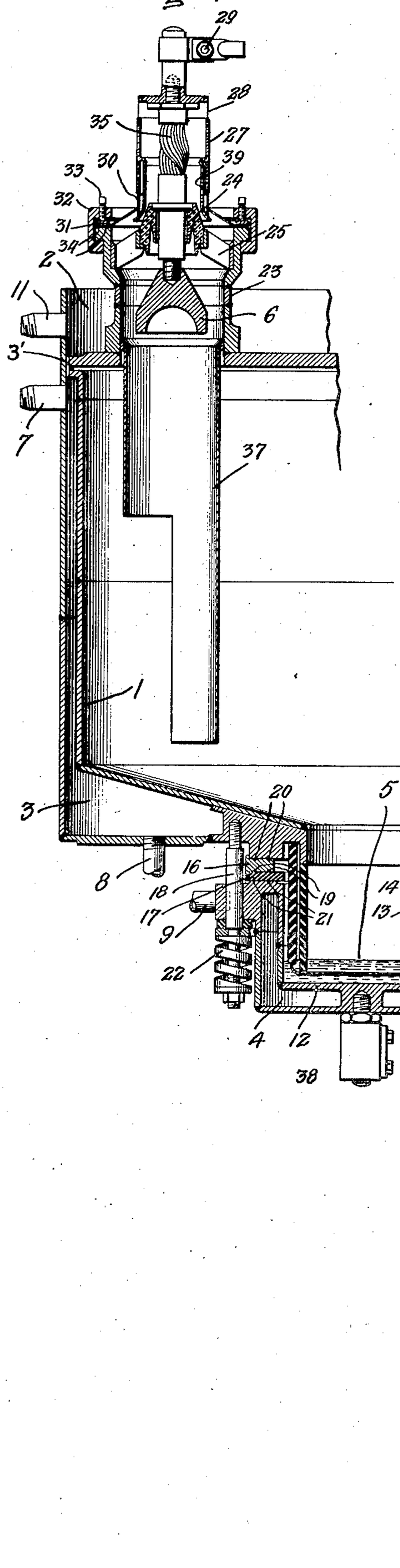
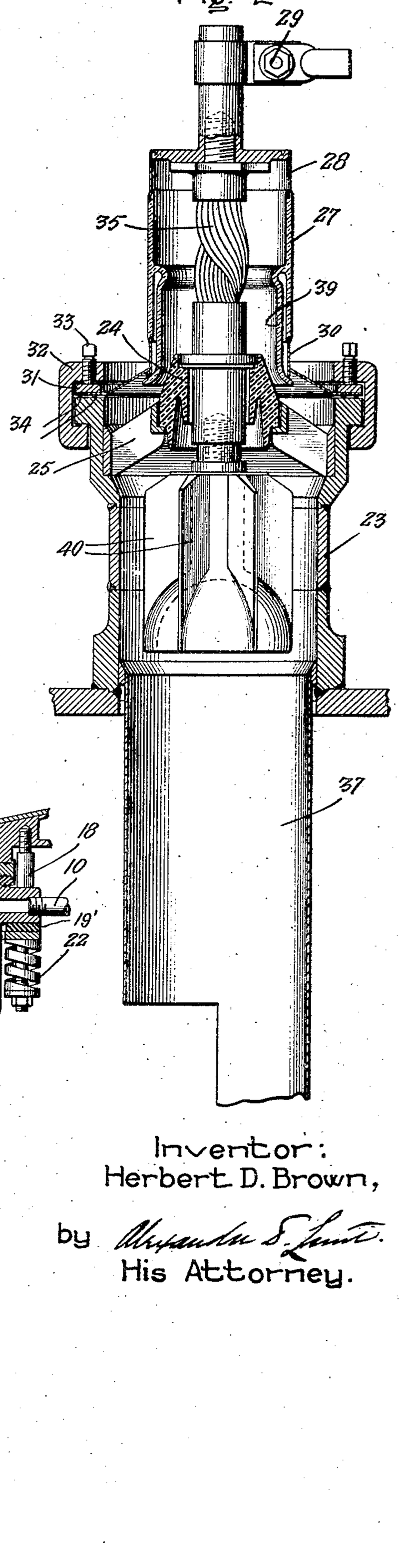


Fig. 2



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UNITED STATES PATENT OFFICE.

HERBERT D. BROWN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC DISCHARGE DEVICE.

Application filed June 3, 1925 Serial No. 34,696.

My invention relates to electric discharge apparatus for transmitting current between direct and alternating current systems, and has for its principal object the provision of an improved arrangement of parts whereby the operation of such apparatus is rendered more efficient and reliable.

It is well known that the load capacity of a discharge device of the vapor electric type is dependent on the temperature attained by its anodes and that this temperature is determined by the voltage drop at the anode surfaces, the magnitude of the current transmitted through the device and the facility with which heat is transmitted from the anodes. If the temperature of an anode becomes too high, gases are driven out of its metallic body, the likelihood of short circuits between the anodes is increased and more rapid disintegration of the anode metal is produced. If a cathode of mercury is used and the anode temperature decreases below a predetermined value, mercury is condensed on the anode and the likelihood of short circuits is greatly increased. In accordance with my invention, these difficulties are largely avoided by the provision of an anode formed and supported in a manner to permit the ready transfer of heat therefrom and by the provision of an improved form of anode chamber or housing through which a low pressure is produced in the immediate vicinity of the anodes and the formation of undesirable arcs is prevented.

My invention will be better understood from the following description when considered in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

Referring to the drawings, Fig. 1 is a sectional view of a mercury rectifier wherein my invention has been embodied; and Fig. 2 is a sectional view showing a modified embodiment of the invention.

Fig. 1 shows a mercury rectifier comprising a vessel 1 which is surrounded by chambers 2, 3 and 4 for circulating a cooling fluid and is provided with a cathode 5 and a plurality of anodes 6, all but one of which have been omitted in order to simplify the drawing. Cooling fluid is admitted to the chamber 3 through an inlet 7 and from this chamber is transmitted through openings 8 and 9 to the chamber 4 from whence it is discharged through opening 10 in any suitable manner. Fluid for cooling the tank 1 is also admitted through opening 7 and opening 31 to the chamber 2, and is discharged therefrom through opening 11. The chamber 2 is open at the top and is interconnected with the chamber 3 through an annular opening 31. This method of circulating the cooling fluid is of particular advantage in that the cooling agent or fluid is first applied to the parts of the tank 1 at which it is desired to produce rapid condensation of the mercury vapor produced by operation of the device, and is then brought into contact with the parts which operate at a comparatively high temperature.

The mercury cathode 5 is supported in a receptacle 12, its upper portion being insulated from the inner surface of this receptacle by means shown as a quartz cylinder 13 and a porcelain cylinder 14 which are interconnected by a member 15 and arranged to float in the mercury of the cathode. It will be apparent that other suitable means of maintaining the cathode spot within the proper area may be utilized. The cathode receptacle 12 is attached to the tank 1 through a joint comprising a metallic collar 16 and an insulation collar 17, a plurality of bolts 18 insulated from the receptacle 12 by insulation gaskets 19′ being provided for compressing the collars 16 and 17 between the lower edge of the tank 1 and the upper edge of receptacle 12 in a manner to make a gas-tight joint. It will be observed that the collar 16 is provided with grooves at its upper and lower surfaces for maintaining the wire hoop gaskets 19 and 20 respectively in place during the assembly of the apparatus; that the upper edge of the receptacle 12 is likewise grooved to receive the wire hoop gaskets 21, and that springs 22 are provided for ensuring that the pressure produced by tightening of the nuts on the lower ends of bolts 18 is evenly applied over the entire surface of the joint.

The anode 6 is provided with a hemispherical cavity at its lower end, is formed at the top in a manner to facilitate the radiation and transfer of heat therefrom to the cool wall 23 of the anode chamber and is mounted on this wall by means of an insulator 24 and an intermediate wheel-shaped member 25 between the spokes or through the perforations of which the heated vapors or gases around the anode are readily circulated in a manner

to bring them into contact with the cool surfaces of the upper part of the anode chamber. With the anode 6 constructed as shown, an approximately uniform temperature is maintained at its surface and the tendency to arcing is greatly reduced. It should be noted that the spokes of the wheel-shaped member 25 are sloped to drain off to one side of the anode any mercury which may condense thereon.

The cover of the anode chamber comprises a sleeve 27 of glass, or other suitable vitreous material, sealed at one end to the metal hood 28 upon which the anode terminal 29 is supported and at the other end to the metal flange-shaped member 30. The rim of the member 30 is clamped between the upper edge of the wall 23 and a collar 31 by means of a split ring 32 and set screws 33, the upper edge of the support 23 being grooved to maintain the wire-hoop gaskets 34 in place during assembly of the apparatus. The terminal 29 is connected to the anode 6 through means comprising a flexible lead 35 by which the seals between the glass sleeve 27 and the metal parts 28 and 30 are protected against injury due to temperature changes and the consequent expansion and contraction of the lead. An insulation cylinder 39 attached at one end to the inner surface of the insulator sleeve 27 is interposed between the anode lead and the lower metal-glass seal to prevent the formation of an arc therebetween.

In the operation of vapor electric devices, it is desirable that the anode be protected from the hot vapor blasts projected from the cathode during operation of the device and that the vapor pressure in the immediate vicinity of the anode be maintained as low as possible in order to minimize ionization in the vicinity of the anode. These results are produced by a tubular member 37 which is suspended from the lower part of the anode support 23 and is cut away at its lower end to form a semi-circular baffle having its concave surface facing the wall of the tank 1. With this arrangement, the anodes are protected from the hot vapors, and these vapors are projected against the top of the tank and deflected downward therefrom in a manner to produce at the lower openings of the tubes 37 an effect by which the vapor pressure within the tube is maintained at a low value.

Current is transmitted through the device by way of terminal 29, flexible lead 35, anode 6, a discharge between anodes 6 and cathode 5, and cathode terminal 38.

Fig. 2 shows an embodiment of the invention which is similar in most respects to that just described but differs therefrom in that the anode is provided with cooling fins 40 having their surfaces formed in a manner to facilitate the transfer of heat from the anode to the inner surface of the anode chamber.

The embodiments of the invention illustrated and described herein have been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the invention is susceptible of being further modified to meet the different conditions encountered in its use and I therefore aim to cover by the appended claims all modifications within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric discharge device comprising means forming an anode chamber, an anode supported at a point intermediate the ends of said chamber, anode supporting means interposed between said anode and the side wall of said chamber in a manner to permit the free circulation of vapor therethrough, and a cathode mounted outside said anode chamber.

2. An electric discharge device comprising means forming a chamber, an insulator spaced from the ends of said chamber, an anode supported through said insulator, and a perforated support member interposed between said insulator and the wall of said chamber.

3. An electric discharge device comprising means forming a chamber, an insulation support member spaced from the ends of said chamber, an anode suspended from said member, and support means interposed between said member and the side wall of said chamber in a manner to permit the free circulation of vapor therethrough.

4. An electric discharge device comprising means forming a chamber, an insulation support member intermediate the ends of said chamber, an anode suspended from said member, and a perforated support member surrounding said insulation member and interposed between said insulation member and the wall of said chamber in a manner to permit the free circulation of vapor within said chamber.

5. An electric discharge device comprising a flexible lead surrounded by a sleeve of vitreous material sealed to a metallic support, and an insulation shield interposed between said lead and said seal whereby arcing between said lead and said seal is prevented.

6. An electric discharge device comprising a flexible lead surrounded by a sleeve of vitreous material sealed to a metallic support, and an insulation shield supported from the inner surface of said sleeve and extending between said lead and said seal whereby the formation of an arc between said lead and said seal is prevented.

In witness whereof, I have hereunto set my hand this 2nd day of June, 1925.

HERBERT D. BROWN.