Dec. 27, 1949 W. J. KNOCHEL 2,492,295

SPARK GAP DEVICE

Filed Nov. 20, 1947

Fig. 1.

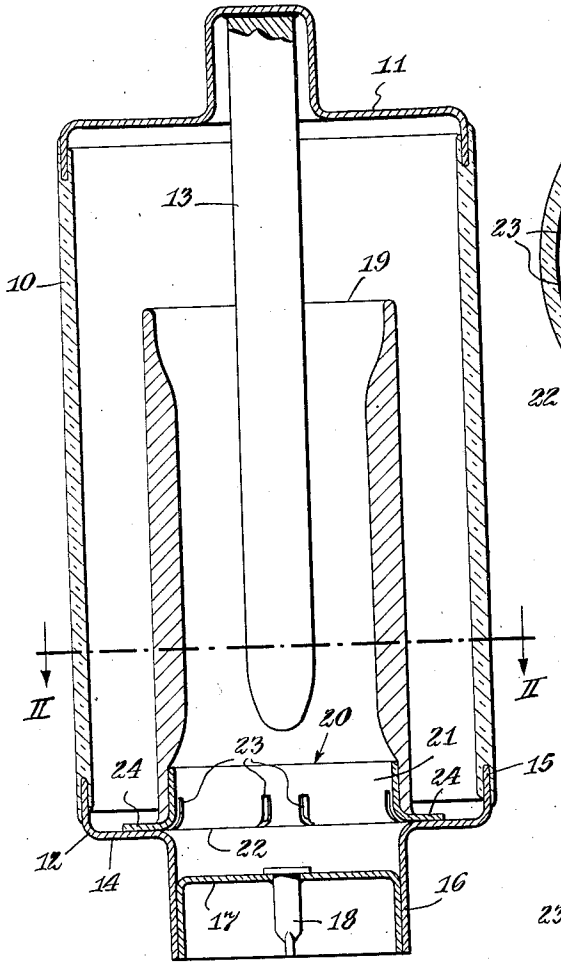


Fig. 2.

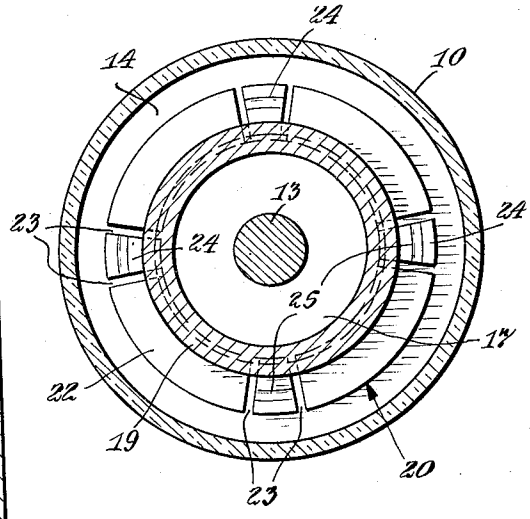


Fig. 3.

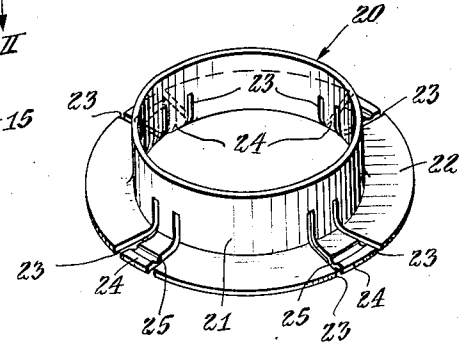
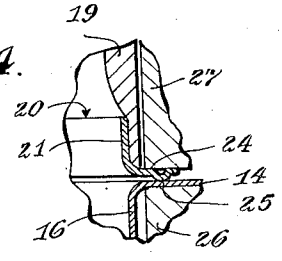


Fig. 4.



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SPARK GAP DEVICE

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3 Claims. (Cl. 250—27.5)

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This invention relates to spark gap devices, and more particularly to devices of that character for use in connection with pulsing of electrical wave energy, and is an improvement upon showing of structures forming the subject matter of United States Patents 2,411,241, 2,422,324, and 2,427,086, all of which are assigned to the same assignee as the present invention.

The commercial devices constructed in accordance with the aforementioned patents have shown a tendency both in manufacture and in use to develop cracks in the glass or elsewhere, the cause of which seems to be due to unequal expansion of parts of different materials. The present invention is directed primarily to overcoming the defect in the prior art construction and to improve thereover by providing a spark gap device capable of withstanding, without injury, very considerable differences of temperature from below freezing encountered in use to or above metal-brazing and glass-sealing temperatures encountered during fabrication. The invention further contemplates accomplishment of its primary purpose without adding to the external dimensions of the device and without alteration of the electrical characteristics and electrode sizes or spacings, and at the same time obtain rigidity in the assembly and simplicity of both the means and methods of fabrication.

Other objects of the invention will appear to those skilled in the art to which it appertains, as the description proceeds, both by direct reference thereto and by implication from the context.

Referring to the accompanying drawing in which like numerals of reference indicate similar parts throughout the several views;

Figure 1 is a longitudinal sectional view of a spark gap device constructed in accordance with the present invention;

Figure 2 is a cross-section of line II—II of Figure 1;

Figure 3 is a perspective view of a uniting collar constituting an essential part of the present invention; and

Figure 4 is a fragmentary longitudinal sectional view showing the collar in process of being welded in place.

In the specific embodiment of the invention illustrated in said drawing, the device selected for examplification herewith comprises a vitreous or glass cylindrical envelope 10 closed at each end by cup-shaped caps or heads 11 and 12 the rims whereof are sealed to the end margins of the glass cylinder. Preferably the caps or heads are of a metal or allow having the same or substantially the same coefficient of expansion as the vitreous or glass cylinder. An appropriate alloy and corresponding glass are described in Patent 2,062,335 of December 1, 1936, and comprise a composition essentially of nickel, cobalt and iron for the alloy and a borosilicate glass cooperating therewith.

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A rod-like electrode or anode 13, which may be of iron or carbon steel is supported coaxially within the cylindrical envelope by being welded at one end to one of said caps or heads, 11, in the same manner as carried out in prior art practice. The other cap or head 12 provides a flat shoulder 14 of washer-like shape the outer periphery of which is spun or bent at right angles to the plane thereof to provide rim 15 to which the glass cylinder is sealed. The inner periphery of said washer-like shoulder also bends or is spun to project at right angles to said shoulder but in a direction opposite to that of the outer peripheral rim, and thereby provides a hollow neck 16 projecting axially outwardly of the envelope. This neck 16 has an annular member 17 welded or otherwise sealed therein for making the envelope vacuum tight, and this member may conveniently provide an exhaust tubulation 18, through which the envelope is exhausted and then recharged with the desired ionizable medium, such as a mixture of about 80% hydrogen and 20% argon at about 680 mm. pressure.

Within the envelope, coaxial with the glass cylinder, and coaxial to and spaced from the anode 13 is a metallic cylinder constituting another electrode or cathode 19, said cathode preferably being aluminum, and projecting longitudinally inward from the said cap having the shoulder 14 and neck 16 above described, said neck and cathode being approximately of equal diameter but extending in opposite directions from the said shoulder.

Intervening between the cathode and shoulder is a supporting and attaching collar 20, detail showing of which appears in Figure 3. Said collar provides a tubular portion 21, at one end of which is a radially outwardly directed flange 22. At intervals circumferentially, the flange is split radially at 23 with the splits continuing part way of the length of the tubular portion, thereby providing tongues 24 integral with the tubular portion following the contour thereof as well as being in part in the same plane as the flange. The planar parts of the tongues furthermore are stamped or otherwise provided with ribs or projections 25 on what may be termed their under faces. Inasmuch as the tubular por-

tion of the collar 20 has approximately the same diameter as the neck 16 of cap 12, said flange and its tongues may be juxtaposed upon shoulder 14 with the collar coaxial to the cap. In the assembly of collar and cap, shoulder 14 is carried upon a lower welding die 26, see Figure 4, and the collar flange is situated on said shoulder and an upper die 27 forcibly pressed downward toward the lower die with simultaneous application of the welding current. By virtue of said projections and simultaneous pressure and welding current, the said tongues are flattened and welded to the shoulder and the entire flange brought into engaging support against the shoulder. The cathode cylinder is applied over the tubular partion of the collar and welded thereto either before or after, but preferably before, welding of the collar to the cap shoulder.

By reference, said collar is of iron the coefficient of expansion of which is close enough to that of the aluminum cathode to assure constant bond therebetween especially in view of the annular portion of the collar and juxtaposed portion of the cathode being thin at the lapping regions thereof. Radial expansion of the shoulder and difference in expansion of the cathode and glass cylinder is accommodated by the flexibility of the several tongues 24. Furthermore, since the iron comprising collar 20 has a coefficient of expansion intermediate between coefficients of expansion of the aluminum cathode 19 and the alloy of end cap 12, the graded assembly likewise alleviates part of the otherwise disruptive strain caused by unequal expansions of cathode, cap, and envelope.

I claim:

1. A spark gap device comprising a cylindrical envelope having a closure at one end and an electrode supported thereby and said electrode extending axially within said envelope from the closure, a metallic cap at the other end of said envelope sealed thereto, a second electrode coaxial to the first said electrode and envelope and extending inwardly of said envelope from said cap, and an intervening member between said cap and second electrode and attached to both

and supporting said second electrode from said cap, said member having a flexible portion between attachment of said member to the second electrode and to the cap.

2. A spark gap device comprising a cylindrical envelope having a closure at one end and an electrode supported thereby and said electrode extending axially within said envelope from the closure, a metallic cap at the other end of said envelope sealed thereto, a second electrode coaxial to the first said electrode and envelope and extending inwardly of said envelope from said cap, and an intervening member between said cap and second electrode and attached to both and supporting said second electrode from said cap, said member having tongues integral therewith and secured to the said cap for constituting the attachment of said intervening member to the cap.

3. A spark gap device comprising a cylindrical envelope having a closure at one end and an electrode supported thereby and said electrode extending axially within said envelope from the closure, a metallic cap at the other end of said envelope sealed thereto, a second electrode coaxial to the first said electrode and envelope and extending inwardly of said envelope from said cap, and an intervening member between said cap and second electrode and attached to both and supporting said second electrode from said cap, said member comprising a collar having a tubular portion secured to said second electrode and having a flange next said cap, said flange having tongues secured to said cap.

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REFERENCES CITED

The following references are of record in the file of this patent:

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2,422,324	Watrous	June 17, 1947
2,427,086	Arnott et al.	Sept. 9, 1947
2,440,153	Oles	Apr. 20, 1948