Dec. 29, 1942. E. LEMMERS 2,306,628

DISCHARGE LAMP WITH PARTITION

Filed Nov. 2, 1940

Fig. 1.

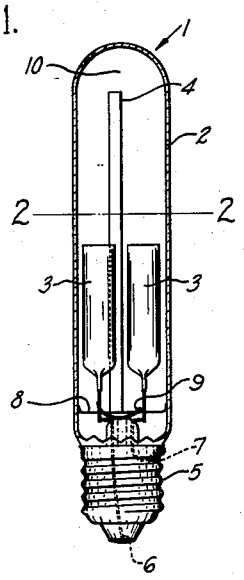


Fig. 3.

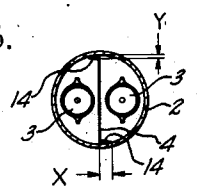


Fig. 2.

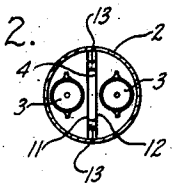
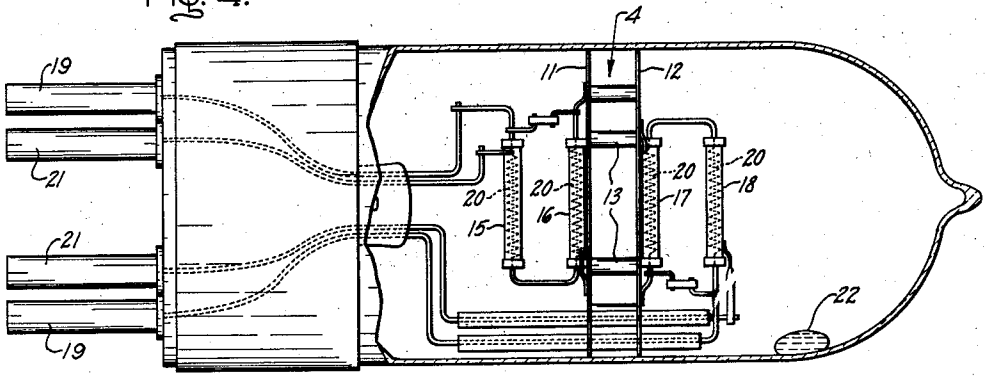


Fig. 4.



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DISCHARGE LAMP WITH PARTITION

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Application November 2, 1940, Serial No. 364,056

3 Claims. (Cl. 176—122)

My invention relates to electric discharge tubes of the type having plural adjacent compartments or channels through which arc streams of different potentials may flow without current leakage from one to the other. More particularly it relates to an improved means for separating those channels one from the other without current leakage.

Hitherto, in the construction of tubes of the aforesaid type, it has been the general practice to use as separators between the plural channels, walls of glass which were integral with the main glass wall or envelope of the tube. Attempts have been made to employ mica shields in place of these glass walls but such attempts have generally been unsuccessful for the reason that it is difficult to obtain a sufficiently close contact or fit between the edge of the mica and the glass to prevent crevices or gaps through which current leakage can take place. The difficulty is particularly troublesome and practically insurmountable where production methods require relatively large manufacturing tolerances. Now I have found these difficulties can be overcome by a relatively simple and economical construction of the mica separator. Generally speaking, the improved construction comprises an added member associated with the mica edge whereby the length of the portion of the leakage path immediately adjacent the tube wall is considerably increased. In other words, the effective width of the partition edge and the width of tube wall covered by the partition edge are made to exceed the gap between partition edge and wall.

It is therefore an object of my invention to provide an electron stream separator of simplified and economical construction.

A further object of my invention is to provide a separator for tubes of the aforementioned type whereby the manufacture of said tubes may be considerably simplified and the cost thereof reduced.

It is still a further object of my invention to provide an improved tube of the type wherein a longitudinal separator divides the tube into adjacent arc guiding channels.

Further objects and advantages of my invention will appear from the following description of species thereof.

For a more complete understanding of the means whereby I attain these objects reference may be had to the following detailed description and accompanying drawing in which like figures indicate the parts throughout and in which:

Fig. 1 is an elevation, partly in section, of a lamp incorporating my invention; Figs. 2 and 3 show alternative cross sections taken along line 2—2 of Fig. 1; and Fig. 4 shows an alternative form of lamp incorporating my invention.

Referring to Figs. 1 and 3 which illustrate the preferred form of the invention, the vapor lamp 1, preferably containing mercury vapor, comprises an envelope 2 and a pair of activated tubular electrodes 3—3 preferably of the cold cathode type coated interiorly with emissive material and closed at their lower ends. Such identical cup cathodes activated only internally are of course primarily intended for operation on alternating current, as is well understood in the art. The said electrodes are each positioned in one of the parallel channels or compartments formed in the envelope by the longitudinal partition or separator 4. These channels will serve as guideways for a U-shaped arc between the electrodes. The separator 4 is preferably, but not necessarily, of an insulating material such as mica, while envelope 2 may be formed in the usual manner of glass or quartz. Suitable conventional base connections are provided by threaded shell 5 and end contact 6 connected by leads 7 to the respective electrodes. An end shield 8 which takes the form of a disc of mica or other material may be provided to close off the lower portion of the tube if desired. Likewise a starting electrode 9 attached to one electrode 3 and projecting through and below disc 8 to the vicinity of the other electrode 3 may be provided. Except for the opening 10 caused by the fact that the separator 4 stops short of the upper end of the tube, the separator or partition 4 thus forms a complete barrier to the passage of current between electrodes 3. However, with the internally activated cup electrodes 3—3 located as shown in Fig. 2 lengthwise of their channels in the envelope 2, the effective length of the discharge path between the electrode mouths via the intercommunication of the channels at the upper end of the partition 4 and envelope 2 toward which the electrode mouths are presented is less than that of the path around the lower end of the partition 4 that would exist in the absence of the shield 8, and the voltage required to produce a discharge via the aforesaid intercommunication is less than that required to produce discharge via the path around the lower partition end. In alternating current operation, furthermore, ionization to maintain short-circuiting discharge along the latter path dies out during each A. C. half cycle, since there is no ionizing emission from the outsides of the cup electrodes 3—3. The relatively low electron emission from the cold cathodes 3—3 is also unfavorable to such a short-circuiting discharge.

It will be apparent that the arc current in flowing between electrodes 3 is forced to travel through opening 10 at the distal end of the tube provided, of course, that no current leaks around the side of the separator through the small crevices which will unavoidably exist between it and the glass, due to the imperfect fit resulting from irregularities in the tube wall and in the mica edges. Under ordinary conditions of manu-

facture it is practically impossible to avoid clearances or gaps of at least 0.010 inch between mica and glass at some points. Crevices of even this size will generally permit sufficient leakage between the arcs to seriously interfere with the operation of the tube.

Now I have found that if a second mica partition be placed parallel to the first and separated therefrom by many times the distance of the clearance between the mica and wall the leakage is stopped. Thus, as indicated by Fig. 2, the partition or separator 4 may comprise two separate mica sheets 11 and 12 spaced apart by separators 13. In this way, the effective width of the partition edge and the width of tube wall covered thereby are made considerably greater than the gap between them. Where the voltage between the arc streams in the adjacent channels is of the order of 30 volts, I have found that the separation distance of the sheets should be at least four times as great as the greatest clearance between the glass wall and the mica. For greater voltage differences it will be necessary to increase this ratio if the leakage is to be stopped.

In the Fig. 3 I have shown a still simpler construction of the separator. Here the separator consists of a single mica sheet 4 having flaps or flanges 14—14 folded to extend along the tube walls for the required distance. In this case, it will be necessary that the projection of the flap along the tube wall be many times the clearance between the main mica edge and the wall, i. e., that the distance x be at least four times the distance y (where the arc potentials differ by about 30 volts). It will be understood that the dimension y is shown somewhat exaggerated for the sake of clarity.

In Fig. 4 is shown an alternative construction for separating adjacent arc chambers or compartments in opposite ends of a cylindrical tube by means of a separator or partition 4 transverse to the axis of the tube. Arcs formed between activated electrodes 15 and 16, and 17 and 18 are series connected across terminals 21—21, the separator 4, which may be of metal, serving as part of the series circuit. If the separator 4 is of insulating material, suitable metallic leads through it will be necessary to complete the electrical circuit. The separator 4 is constructed as in Fig. 2. The electrodes 15 to 18 may be initially brought up to operating temperature by insulated heaters 20 each positioned within one of the electrodes 15 to 18 and all forming with shield 4 a series circuit across terminals 19—19. Mercury drop 22 may serve as a source of ionizable working vapor.

Although I am unable to state with certainty a theory for the improved operation resulting from my invention, it is my belief that the added flaps and mica sheets so increase the length of that portion of the leakage path which is immediately adjacent to the tube wall that insufficient ions may leak through to sustain an arc, i. e., by pushing the leakage arc up to the tube wall the ion loss to that wall becomes great enough to quench the arc until a greater voltage is supplied. The phenomenon is analogous to the progressive increase in the necessary arc sustaining voltage which occurs when the envelope about any arc is constricted progressively.

It will be understood of course that my invention is not limited in any way by any theory of operation recited here. Further it will be understood my invention is not to be limited by any structural details herein shown and that many modifications within the scope of the appended claims may occur to those skilled in the art to which it pertains.

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

1. An electric discharge device comprising a tubular discharge envelope with a cup electrode in one side thereof presenting its mouth toward one end of the envelope and activated internally only, a coacting cup electrode in the other side of said envelope presenting its mouth toward the same end thereof, a longitudinal partition between said cup electrodes effectively shorter than the envelope and dividing its interior into longitudinal channels communicating at the partition end toward which the electrode mouths are presented, the longitudinal partition edges fitting the tube wall imperfectly but covering widths of wall surface so far exceeding the gaps between edges and wall as to prevent leakage of discharge current through the gaps, and the cup electrodes being so located lengthwise of their respective channels that the effective length or resistance of the path for discharge between the electrode mouths via the intercommunication aforesaid is less than that of a path around the other end of said partition.

2. An electric discharge device comprising a tubular discharge envelope with coacting cup cathodes therein activated internally only and presenting their mouths toward the same end of the envelope, a longitudinal partition between said cup electrodes effectively shorter than the envelope and dividing its interior into longitudinal channels communicating at the partition end toward which the electrode mouths are presented, the longitudinal partition edges fitting the tube wall imperfectly but covering widths of wall surface so far exceeding the gaps between edges and wall as to prevent leakage of discharge current through the gaps, and the cup electrodes being so located lengthwise of their respective channels that the voltage required to produce discharge between the electrode mouths via the intercommunication aforesaid is less than that required to produce discharge between the mouth of one electrode and the exterior of the other around the other end of said partition.

3. An electric discharge device comprising a tubular discharge envelope with a cold operating cup electrode in one side thereof presenting its mouth toward one end of the envelope and activated internally only, a coacting cold operating cup electrode in the other side of said envelope presenting its mouth toward the same end thereof, a longitudinal partition between said cup electrodes effectively shorter than the envelope and dividing its interior into longitudinal channels communicating at the partition end toward which the electrode mouths are presented, the longitudinal partition edges fitting the tube wall imperfectly but covering widths of wall surface so far exceeding the gaps between edges and wall as to prevent leakage of discharge current through the gaps, and the cup electrodes being so located lengthwise of their respective channels that the voltage required to produce discharge between the electrode mouths via the intercommunication aforesaid is less than that required to produce discharge between the mouth of one electrode and the exterior of the other around the other end of said partition.

EUGENE LEMMERS.