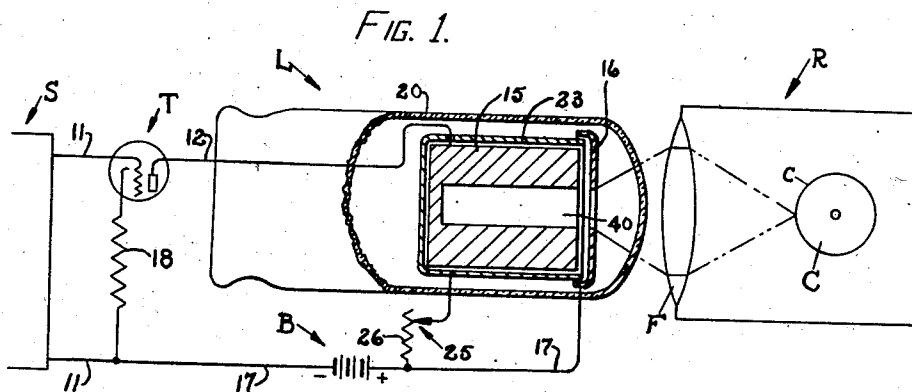
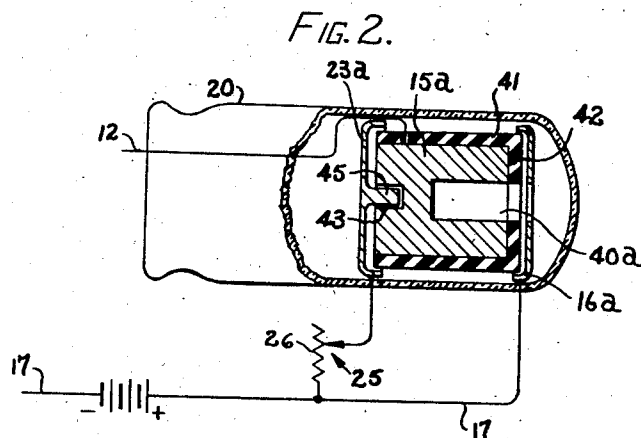


July 20, 1948.

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MODULABLE ELECTRIC DISCHARGE LAMP
Original Filed Feb. 12, 1942

2,445,679



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2,445,679

MODULABLE ELECTRIC DISCHARGE LAMP

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Original application February 12, 1942, Serial No. 430,593. Divided and this application August 30, 1944, Serial No. 551,793

1 Claim. (Cl. 176-122)

1

This invention relates to the modulation of an electric discharge, and is especially concerned with controlling the relation between variation of the discharge current and resulting variation in the intensity of the radiation, visible or otherwise, from the discharge. The invention permits of constructing a modulable discharge lamp in which the intensity or brilliance of radiation from the discharge varies in a greater proportion than the discharge current, and, if desired, in a very large proportion. Provision can be made to adjust and vary at pleasure the proportional relation between variation of discharge current and corresponding variation of intensity of radiation. The invention is useful in connection with the translation of electrical signals derived from phenomena of almost any kind into light or other radiation, and is particularly applicable to discharge devices or lamps resembling the type known as "crater lamps."

This application is a division of my application Serial No. 430,593, filed February 12, 1942, in which is described and claimed lamps of the positive column type, whereas the lamps specifically disclosed and claimed in this application are of the well known negative glow type.

My discharge device or lamp may comprise a cathode and a main anode spaced in front of the cathode and so arranged that the discharge between cathode and anode is visible end-on past the latter. Provision for modulating the potential difference and the total discharge current in the lamp may be made in any suitable manner, in accordance with any desired phenomenon or signal. For the purposes of my invention, another anode or control electrode may also be provided, with means for maintaining a potential difference and a resulting discharge between the cathode and this other anode. Accordingly, a part of the discharge is diverted or bled off from the main discharge (out of its path to the main anode) in a greater or less proportion, with the result that the end-on intensity of the radiation from the main discharge varies in a greater proportion than does the total discharge current. One way of accomplishing this is to connect the other anode to the main anode through a resistance; and one way of varying the proportional relation between variation of the total discharge current and corresponding variation of intensity of radiation is to vary or adjust this resistance. Various arrangements and constructions may be employed, several of which will be illustrated and explained.

Still other features and advantages of the in-

2

vention will appear from the following description of species and forms of embodiment, and from the drawings.

In the drawing, Fig. 1 is a fragmentary diagrammatic view of a lamp comprising my invention, together with a signal system and suitable circuit, and Fig. 2 is a diagrammatic view of a modified form of the lamp.

Fig. 1 illustrates my invention as used in a system where signals in the form of electrical impulses of varying intensity received from a source S are to be translated into luminous or other radiation of varying intensity which acts on any desired receiving system or responsive means R for displaying or registering the same, here illustrated as including a focusing lens F and a photosensitive chart C carried by a revolving cylinder C and responsive to the light spot from the lens F. Electrical amplifying means may be interposed between the signal source S and the lamp L, being here illustrated as a vacuum tube T for producing substantially distortionless amplification. This tube T is shown connected in the usual manner to receive signals from the source S through an input circuit 11 and to feed the amplified output to the electrical discharge device or lamp L through an output circuit 12. A suitable D. C. source of discharge current B for the discharge device or lamp L is shown connected between the lamp cathode 15 and anode 16 through a power circuit 17, the amplifier T, and the amplifier output circuit 12.

As shown in Fig. 2, the lamp L is of the well known negative glow type comprising a glass envelope 20 enclosing the cathode 15 which consists of a hollowed cylindrical metal body with the mouth of its axial hole or bore 40 open at one end. The main anode 16 has the form of a sheet metal cap over and around the open end of the body 15, centrally apertured in axial alignment with the hole 40 and having a flange extending toward the anode, while the other anode or control electrode 23 has the form of a sheet metal cylinder spaced around the body 15 and thus insulated from it, and also insulated from the anode 16. The cylinder constituting the control electrode 23 extends inside the flange of the anode structure. The anode is so arranged that the negative glow discharge in the crater is visible end-on past it. The envelope contains a suitable gaseous atmosphere, as well known in the art. The crater or anode 23 is electrically connected to the anode 16 through a connection 25, shown as including an adjustable resistance 26 located

3

outside the envelope 20, and also a portion of the circuit 17.

In operation, the discharge current in the lamp L is proportional to the signal intensity from S. The intensity of the endwise radiation from the discharge toward the receiving system R depends on the discharge current. In the absence of the anode means 23 with its connection 25, the intensity of the discharge would vary in sole dependence of the discharge current. However, the resistance 26 in the connection 25 makes the part 23 an anode of lower potential relative to the cathode 15 than the main anode 16, so that part of the discharge goes to this part 23, diminishing its end-on intensity of radiation. The degree to which this takes place depends on the magnitude of the resistance 26 in the connection 25, as well as on the position of the part 23. If the effective resistance 26 were zero, all the discharge would go to the part 23; if it were infinite, or virtually so, all the discharge would go to the main anode 16. The positive potential of the part 23 relative to the discharge within it depends, of course, on the value of the resistance 26, and can be increased by reducing this resistance, and vice versa.

Whatever the value of the resistance 26, the effect of the part 23 and the connection 25 on the current-light curve of the device is subtractive in the sense that the light for a given discharge current flowing in the circuit 17 is reduced. Naturally, this effect is proportionally greater for low currents, since the smaller the current flow, the greater the proportion of it that can be accommodated by the path via the part 23 and the resistance 26, which gives rise to a lower intensity of radiation than an equal current via the main anode 16. Accordingly, the lower end of the current-light curve is depressed very greatly in proportion to its height above zero, while the upper end of this curve is scarcely affected. Thus the connection 25 with its resistance 26 makes the end-on intensity of radiation toward the receiving system R vary in a greater ratio than the discharge current, and this ratio can be altered by adjusting the resistance 26.

Fig. 2 illustrates diagrammatically a somewhat different type of crater lamp of the negative glow type also embodying the invention. Here the cathode 15a consists of a hollowed cylindrical metal body enclosed in an insulative sleeve 41 with an internal flange 42 covering one end of the body 15a around the mouth of its exposed

4

major cathode hole 40a. The mouth of a minor cathode hole 43 in the other end of the body 15a is also exposed. The main anode 16a has the form of a sheet metal cap over and around the flanged end of the insulator 41, centrally apertured in axial alignment with the major hole 40a, while the other anode 23a has the form of a sheet metal cap over and around the other end of the insulator 41 and cathode 15a, with a central metal boss 45 projecting into the minor hole 43. The circuit connections are essentially the same as shown in Fig. 1, and are marked with the same reference characters, as a means of dispensing with repetitive description.

The embodiment of applicant's invention shown in Fig. 2 is being claimed in copending patent application Serial No. 787,117, filed November 20, 1947, and which is assigned to the assignee of this application.

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

A modifiable gaseous electric discharge lamp of the negative glow type comprising a sealed envelope containing an ionizable medium, a hollow cathode having an internally electron emissive bore, an annular sheet metal anode in front of said cathode and aligned axially with said bore and having a flange extending toward said cathode, and a shell-shaped sheet metal control electrode closely surrounding and enclosing the sides and back end of said cathode and extending inside said flange.

EUGENE LEMMERS.

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