April 30, 1935. G. F. BRETT 1,999,649

ELECTRIC DISCHARGE LAMP

Filed Feb. 19, 1932

Fig. 1

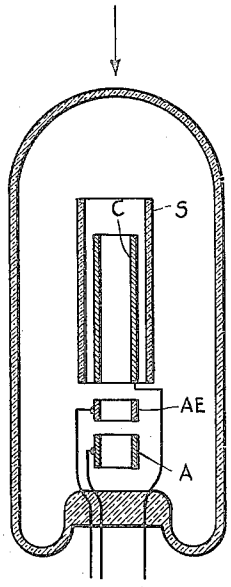


Fig. 2

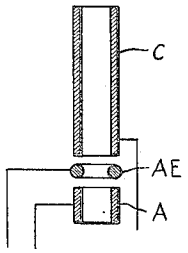


Fig. 3

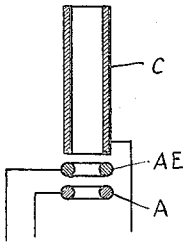


Fig. 4

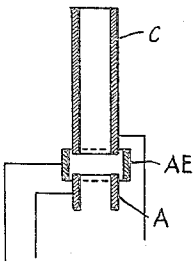
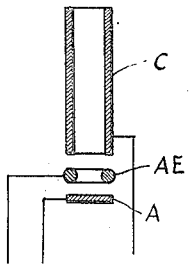


Fig. 5



INVENTOR
G. F. BRETT
BY W. G. Brown
ATTORNEY

Patented Apr. 30, 1935 1,999,649

UNITED STATES PATENT OFFICE

1,999,649

ELECTRIC DISCHARGE LAMP

George Fairburn Brett, Leeds, England, assignor to Radio Corporation of America, a corporation of Delaware

Application February 19, 1932, Serial No. 593,979
In Great Britain February 21, 1931

2 Claims. (Cl. 176—122)

This invention relates to electric discharge lamps and has for its object to provide an improved electric discharge lamp suitable for use for picture recording, television, and like purposes.

More particularly the invention relates to electrc discharge lamps comprising more than two electrodes, i. e. electric discharge lamps comprising an anode, cathode and a further electrode.

Two of the principal disadvantages in ordinary two electrode glow discharge lamps are that a comparatively high striking voltage is necessary while the current voltage characteristic curves exhibit a considerable hysteresis effect, i. e. the curve obtained for ascending values of voltage is not the same as that obtained for descending values. This hysteresis effect is usually associated with instability at low current values at which values the luminous discharge may suddenly cease altogether without apparent cause. Further where a lamp is employed for picture recording or television or like purposes, bad reproduction generally results, since the current at the striking voltage may be different on two different occasions. These effects of instability and lack of reproducibility become especially noticeable when the discharge path is long and constricted, and therefore these effects are particularly serious in discharge lamps suitable for use in picture recording and television, since as is well known the discharge path in such lamps is almost always long and constricted.

According to this invention an electric discharge lamp comprising an anode and a cold cathode is provided with an auxiliary electrode which is of very small area relative to the cathode proper.

The invention is illustrated in several of its preferred forms by the accompanying drawing, wherein:

Fig. 1 represents a vertical section through a discharge tube in accordance with a preferred modification of my invention, and wherein

Figs. 2 through 5 inclusive represent sectional views through the electrode structure of modified forms of the invention set forth by Fig. 1. By these figures, Fig. 2 represents the use of an auxiliary electrode formed as a loop or ring of wire; Fig. 3 represents a similar formation of auxiliary and anode electrodes, each formed from a ring or loop of wire; Fig. 4 represents the use of an auxiliary electrode of cylindrical formation which surrounds the space between the cathode and anode; and Fig. 5 is a modification of the showing of Fig. 2 wherein the anode member is arranged opposite the opening in a cylindrical cathode.

Referring to Figure 1 an electric discharge lamp comprises a cathode C of fairly large area made in the form of an open ended cylinder of nickel iron or other suitable metal. Co-axial with the cathode and closely adjacent thereto is an auxiliary electrode AE consisting of a cylinder of the same diameter as the cathode, but of very much shorter length, the area of the auxiliary electrode being thus much smaller than that of the cathode. Closely adjacent the auxiliary electrode is a cylindrical anode A which is again co-axial with the other two electrodes and is again constituted by a cylinder of the same diameter. The anode cylinder need not be long and may conveniently be intermediate in length between the length of the cathode and the length of the auxiliary electrode. All three electrodes may consist of nickel or other suitable metal and are mounted in a glass bulb containing a suitable gas mixture at a pressure of a few millimetres of mercury.

In a modification shown in Figure 2, the auxiliary electrode AE may be constituted by a ring of wire instead of by a short cylinder; or, as shown in Figure 3 the auxiliary electrode AE and the anode A may each be constituted by a ring of wire.

In a further modification, the electrodes are so arranged that the light from the discharge in the auxiliary electrode circuit seen in the direction of the cathode is very small. Such a modification is shown in Figure 4 in which the auxiliary electrode AE is in the form of a collar surrounding the small gap between the anode A and the cathode C.

The cathode may be mounted in a glass shield or sleeve S (see Figure 1) and the leads to the cathode and the auxiliary electrode and if desired, to the anode also, should be glass covered in order to prevent discharge taking place, otherwise than in the desired manner. The glass covering is not shown in the drawing.

In the modification shown in Figure 5 the anode A is in the form of a plate or disc opposite the end of the cathode C and on the other side thereof from the auxiliary electrode AE. If desired, the positions of the auxiliary electrode and the anode of a discharge lamp in accordance with this invention may be interchanged. Such interchanging has the effect of lowering the striking voltage but the stability may be found to be somewhat reduced as compared to that obtaining in the arrangement illustrated.

The accompanying drawing is approximately to scale and although it is not intended that the invention shall be limited to the particular dimensions given it has been found satisfactory to make the cathode cylinder about 2–3 cms. long and about 2–4 mms. in diameter. These dimensions are, however, not critical. The three electrodes are placed comparatively close to each other preferably less than 1 mm. apart with a view to the obtaining of maximum stability and minimum striking voltage. The construction shown in Figure 3 offers the practical advantage that it is very easy to construct and requires very little metal.

It will be noted that the glass sleeve S shown in Figure 1 is extended a little way beyond the end of the cathode C. This extension serves to reduce blackening of the envelope opposite the cathode due to cathode sputtering and therefore has the effect of increasing the useful life of the lamp.

The arrow in Figure 1 indicates the direction from which the lamp therein shown is intended to be viewed.

When electrical discharge lamps in accordance with this invention are in use a continuous small localized discharge is maintained in the lamp from the auxiliary electrode; this discharge acting as a "trigger" for the main discharge between the cathode and anode and causing the main discharge to occur and be extinguished smoothly for all values of operating current.

It will thus be seen that a small change in the current between the auxiliary electrode and the anode has little or no effect in the discharge between the cathode and the anode, while even a large relative current change in the circuit of the auxiliary electrode produces no appreciable change in the main discharge circuit for ordinary operating voltages.

It will also be seen that in electric discharge lamps in accordance with this invention, the auxiliary electrode is in effect part of the cathode for the three electrodes are separated from one another only by a very small space; in practice separations of one half millimetre between adjacent electrodes has been found satisfactory. Again, owing to the relative size and arrangement of the electrodes the total auxiliary current is always very small and in one practical case has only been about one half milliampere, i. e. about 2% of the maximum main current.

Having now described the invention, what is claimed and desired to protect by Letters Patent is the following:

1. An electric discharge tube comprising a tubular anode electrode, a tubular cathode electrode axially separated from the anode, and a tubular auxiliary electrode positioned between the anode and cathode and surrounding the space between the anode and cathode, and an envelope enclosing all of the electrode elements.

2. An electric discharge tube comprising a tubular anode electrode, a tubular cathode electrode axially separated from the anode, and a ring-like auxiliary electrode positioned between the anode and cathode and surrounding the space between the anode and cathode, and an envelope enclosing all of the electrode elements.

GEORGE FAIRBURN BRETT.