

Oct. 21, 1941.

P. W. BLACKBURN

2,259,947

TRIGGER FOR DISCHARGE DEVICES

Filed May 11, 1939

2 Sheets-Sheet 1

Fig. 1.

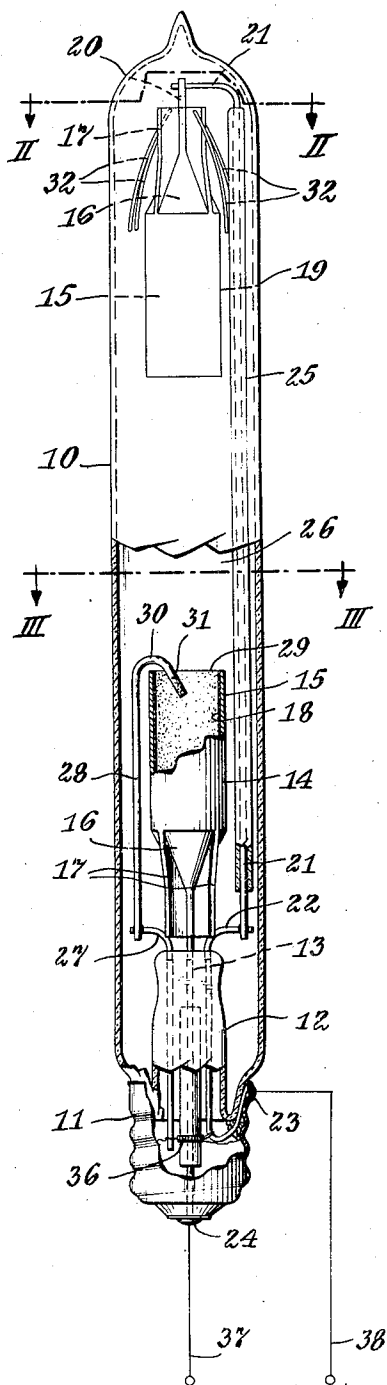


Fig. 2.

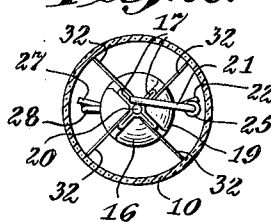


Fig. 3.

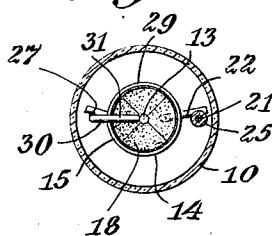
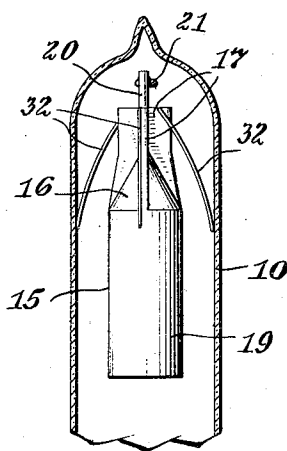


Fig. 4.



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2 Sheets-Sheet 2

Fig. 5.

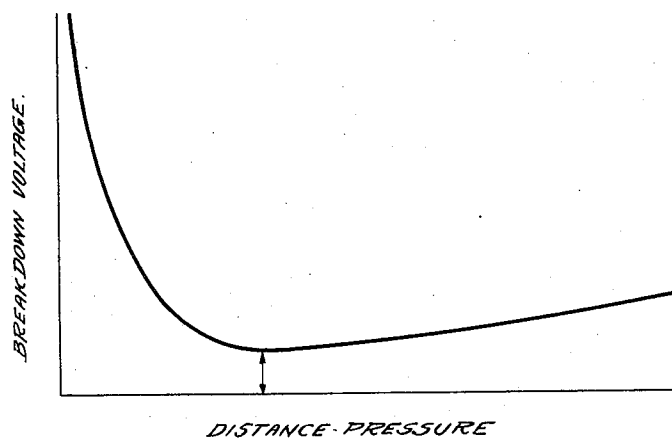


Fig. 6.

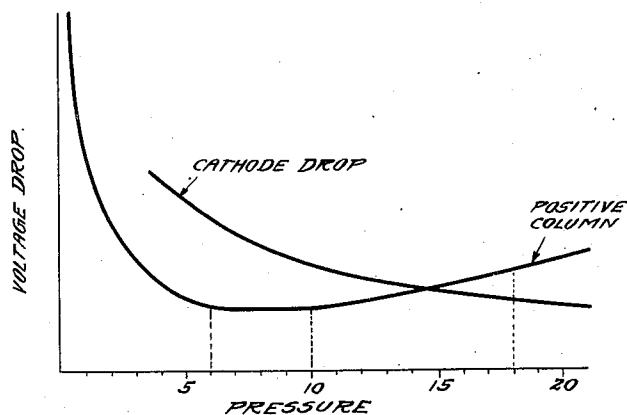


Fig. 7.

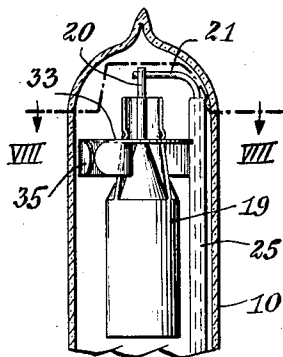
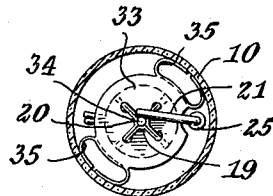


Fig. 8.



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UNITED STATES PATENT OFFICE

2,259,947

TRIGGER FOR DISCHARGE DEVICES

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Application May 11, 1939, Serial No. 272,966

8 Claims. (Cl. 176—126)

My invention relates to discharge devices and especially discharge devices having cold electrodes.

An object of the invention is to provide a discharge device having a low starting voltage that is approximately that of the operating voltage of the device.

Another object of the invention is to provide a discharge device that will both start and operate on the usual commercial alternating current voltage lines of 110 volts.

Another object of the invention is to provide a discharge device in which charges will not accumulate on the bulb to interfere with the discharge to the electrodes.

Other objects and advantages of the invention will be apparent from the following description and drawings in which

Figure 1 is a view partly in cross-section and partly in elevation of a discharge device disclosing a preferred embodiment of the invention.

Figure 2 is a cross-section on lines II—II of Figure 1.

Figure 3 is a cross-section on lines III—III of Figure 1.

Figure 4 is an enlarged view of the upper portion of Figure 1 at a slightly different angle to illustrate the means for removing the charges on the bulb walls.

Figure 5 is a curve disclosing the breakdown voltage in respect to the product of the electrode spacing and gas pressure.

Figure 6 is a curve illustrating the voltage drop of the positive column and the cathode drop in respect to gas pressure.

Figures 7 and 8 are side and top elevation views of a modification of the wall-charge-removing means illustrated in Figure 4.

In a broad generic sense, my invention is an improvement over the sterilizing discharge lamp disclosed in the application of Robert F. James, Serial No. 734,620, filed July 11, 1934, for Radiating apparatus. It is one of the special objects of my invention that the devices constructed in accordance therewith, shall reliably start and operate at the usual commercial line voltage of approximately 110 volts.

It is an incidental object of the invention that the discharge device shall be capable of occupying a very small space and so be suitable for installation in places where space is required for other objects. One of the installations for which the device is especially suitable is that of a re-

frigerator where the rays will prevent the growth of bacteria harmful to food.

In Figure 1 is disclosed the generally preferred assembly of a discharge device constructed in accordance with my invention.

The bulb 10 is preferably of the elongated, small diameter shape disclosed with the standard screwthreaded base 11 attached at one end. The glass of this bulb is preferably borosilicate glass free from iron, having an ultraviolet transparency for wavelengths longer than 2500 A. U., such as a glass commercially known as "Corning #972 Corex glass, high transmission ultraviolet glass," which has a transmission range in which lies the most highly bactericidal radiations. This glass transmits the mercury radiations of 2530 and 2540 A. U., which comprises more than 60% of the total radiations generated between 2500 and 3100 A. U.

The bulb has a re-entrant press 12 at the base end, and this press has preferably a central conductor 13 passing therethrough, and connected to and supporting a glow discharge electrode 14. This electrode may be of various shapes, but I especially prefer the electrode disclosed in my Patent #2,029,013 issued January 28, 1936, for "Cathode for discharge devices." This cathode preferably comprises a main hollow cylindrical body 15, tapering at one end to a conical portion 16 having integral fins 17 which combine the dual purpose of dissipating heat from the closed end of the electrode, and also provide a convenient method of attachment to the conductor as illustrated in this figure, and especially in Figure 2.

The interior of the hollow cylindrical portion 15, is coated with an electron-emitting material 18, which is preferably of the standard strontium, barium and calcium oxides.

At the upper end of the tube, I preferably locate another electrode 19 which is preferably a duplicate in structure of the electrode 14, just described. This electrode has its open end facing the open end of the electrode 14, and has a similar electron-emitting coating on the interior portion thereof. The electrode is connected to a conductor 20 which is, in turn, supported by a standard 21 which passes along the discharge space between the two electrodes, and is supported at its lower end by a conductor 22 passing through and supported by the press 12. One of these conductors, such as 22, is connected to the screw threaded conductive portion, as illustrated at 23, and the other conductor, such as 13, is connected to the insulated connecting tip 24.

The conductor 21, passing along the discharge space, is insulated in order to prevent a glow discharge thereto, from the electrodes. This insulation 25 may be a glass coating or any insulating sleeve, or may be a coating of finely divided aluminum powder put on with a suitable binder therein. The covering of aluminum powder prevents a glow discharge to the conductor. If desired, the conductor may be coated at some portions with glass and at other portions with finely divided aluminum powder. The discharge space 26 between the two electrodes is preferably of the order of an inch-and-half in the preferred embodiment disclosed.

A third conductor 27 is sealed through the press 12 and supports a standard 28 extending along side of the electrode 14. The upper end of the standard 28 is bent over the upper rim or edge 29 of the electrode 14, as indicated at 30, and then extends downwardly at an angle to within the hollow electrode, as disclosed at 31. It will be noted that the portion 31 forms a varying distance from the inner electron-emitting coating of the electrode 14, for a purpose explained hereinafter. The tip 31 has a film at least of electron-emitting coating thereon. This film may be placed in various ways thereon, but it is generally sufficient to cause a slight sputtering of the material 18 onto the tip 31, by means of a discharge between the two.

At the upper portion of the electrode 19, namely on the flat sides of the fins 17, are attached flexible and conductive wires 32. These wires are preferably round thin wires that are bent outwardly so that they make an adequate pressure contact with the bulb wall 10, as more particularly illustrated in Figure 4. These wires help in centrally spacing and supporting the free end of the electrode structure in the upper portion of the tube, but their main purpose is to have a conductive connection between the bulb walls and the upper electrode, so that any charges on the glass walls will be absorbed immediately by the upper electrode 19, and these charges will not accumulate to cause a disturbance of the discharge between the two electrodes. The re-entrant connecting supports for the upper electrode may have various shapes, such as that disclosed in Figures 7 and 8, wherein a band 33 is perforated at 34 to accommodate the fin and shank portion of the electrode 19, and this band 33 has a curved re-entrant band 35 at its outer ends, making a re-entrant contact with the curved walls of the tube.

The starting electrode 28 is preferably connected through a resistance 36 in the base of the tube to the conductor 22, connected to the upper electrode 19. This resistance is preferably of 50,000 ohms, although the range of 25,000 to 75,000 may also be utilized.

The gaseous atmosphere in the tube is, of course, that of mercury vapor, in order to provide the sterilizing radiations therefrom. For discharge purposes, however, this mercury vapor is carried by one, or a combination of the rare gases such as argon, or argon and neon.

One of the purposes of the invention, is to provide a discharge device having a voltage drop suitable for both starting and operating on the commercial 110 volt circuit. The two main portions in the discharge device that create the major portion of the voltage drop are the positive column and the so-called cathode drop. In Figure 6, I have illustrated the curve of voltage drop of the positive column with regard to pres-

sure, and also the cathode drop in regard to pressure for my preferred gaseous atmosphere.

The tube in the preferred form, has an optimum pressure of 10 to 15 mm. of mercury, although the range may be extended to 18 mm. of pressure. It will be noted from Figure 6 that in this range both the positive column and the cathode drop are approximately at their combined low-voltage drops. The positive column has a minimum at approximately 6 mm. of pressure, and the cathode or negative glow has a minimum at about 30 mm. of pressure. The range of 10 to 15 mm. of pressure, however, provides a minimum of voltage drop of the combination of the two.

Another object of my invention is to insure starting of the discharge. The voltage for breakdown curve in respect to the distance between the electrodes times the pressure is illustrated in Figure 5. The gas within the bulb is sometimes "cleaned up" in operation so that the pressure may change slightly within the tube. It will be noted that the starting electrode 28 is bent at an angle with the interior cylindrical side 18 of the electrode 14. The distance A, for minimum voltage breakdown will always be present between the inner cylindrical surface 18 of the electrode 14 and the sloping portion 31 of the auxiliary electrode 28 because of the varying close spacing resulting from the angle arrangement. As a consequence, the discharge will always be initiated between the starting tip 31 and the electrode 14 with the commercial voltage supplied. The moment that a discharge starts between the starting electrode and the electrode 15, the gaseous medium will be ionized and the discharge will breakdown between the electrode 14 and the electrode 19, on account of this path being of less voltage drop with ionization than the path through the 50,000 ohms of the resistance 36. The angle of the starting electrode projecting within the electrode 15, accordingly, insures the reliable starting of the device whenever it is connected to the commercial lines illustrated by 37 and 38. Another similar starting electrode may be associated with the upper electrode 19, but this is not necessary with most of the installations.

Although I have shown and described specific embodiments of my invention, I do not desire to be limited thereto, as various other modifications of the same may be made without departing from the spirit and scope of the appended claims.

I claim:

1. A discharge device comprising a container, a gaseous atmosphere therein, a cylindrical electrode in said container, a starting electrode having the active portion within said cylindrical electrode at an acute angle with the cylindrical side thereof, the spacing between said cylindrical electrode and the active portion of said starting electrode being the distance for minimum voltage breakdown for the gaseous atmosphere and another main electrode cooperating with said cylindrical electrode.

2. A discharge device comprising a container, a gaseous atmosphere therein, a cylindrical electrode in said container, an electron emitting coating on the inner surface of said cylindrical electrode, a starting electrode having the active portion within said cylindrical electrode at an acute angle with the cylindrical side thereof, the spacing between said cylindrical electrode and the active portion of said starting electrode be-

ing the distance for minimum voltage breakdown for the gaseous atmosphere and another main electrode cooperating with said cylindrical electrode.

3. A discharge device comprising a container, a gaseous atmosphere therein, a cylindrical electrode in said container, an electron emitting coating on the inner surface of said cylindrical electrode, a starting electrode having the active portion within said cylindrical electrode at an acute angle with the cylindrical side thereof, at least a film of electron emitting material on said starting electrode, the spacing between said cylindrical electrode and the active portion of said starting electrode being the distance for minimum voltage breakdown for the gaseous atmosphere, and another main electrode cooperating with said cylindrical electrode.

4. A discharge device comprising a container, a gaseous atmosphere therein and also therein an electrode assembly comprising a press, conductors sealed through said press, a cup shaped electrode supported by one of said conductors, and another electrode extending from another of said conductors along side of said cup shaped electrode and having its free end bent over the rim to the interior of said cup.

5. A discharge device comprising a container, a gaseous atmosphere therein and also therein an electrode assembly comprising a press, conductors sealed through said press, a cup shaped electrode supported by one of said conductors, and another electrode extending from another of said conductors along side of said cup shaped electrode and having its active free end bent over the rim into the interior of said cup at an acute angle with the interior wall of said cup-shaped electrode, the spacing between said interior wall and said active free end of said other electrode being the distance for minimum voltage breakdown for said gaseous atmosphere, a standard connected to still another conductor and an electrode supported from said standard

in spaced relation to said first two mentioned electrodes.

6. A discharge device comprising a container, a gaseous atmosphere of mercury vapor and at least one of the noble gases at a pressure of 10 to 18 millimeters of mercury therein and also therein an electrode assembly comprising a press, conductors sealed through said press, a cup shaped electrode supported by one of said conductors, and another electrode extending from another of said conductors along side of said cup shaped electrode and having its active free end bent over the rim to the interior of said cup at an acute angle with the interior wall of said cup-shaped electrode, the spacing between said interior wall and said active free end of said other electrode being the distance for minimum voltage breakdown for said gaseous atmosphere, a standard connected to still another conductor and an electrode supported from said standard in spaced relation to said first two mentioned electrodes, a container enclosing said electrodes, and resilient conducting means attached to said last mentioned electrode in contact with the inner wall of said container.

7. An electrode for a gaseous discharge device comprising a tubular body having fins extending from the exterior surface thereof in substantially parallel relation with the longitudinal axis of the body, and resilient means attached to the sides of said fins and extending laterally and longitudinally whereby said electrode will be suitably spaced from any adjacent wall.

8. An electrode for a gaseous discharge device, comprising a tubular body having fins extending from the exterior surface thereof in substantially parallel relation with the longitudinal axis of the body, and resilient wires attached to the sides of said fins and extending laterally and longitudinally whereby said electrode will be suitably spaced from any adjacent wall.

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