July 16, 1940. C. G. SUITS 2,208,439

HIGH INTENSITY LIGHT SOURCE

Filed March 26, 1938

Fig. 1.

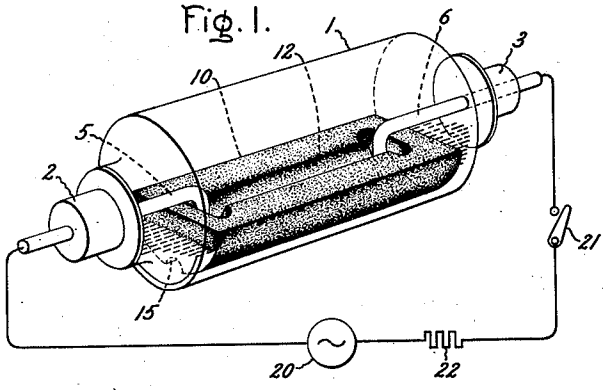


Fig. 3.

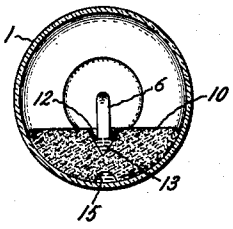


Fig. 2.

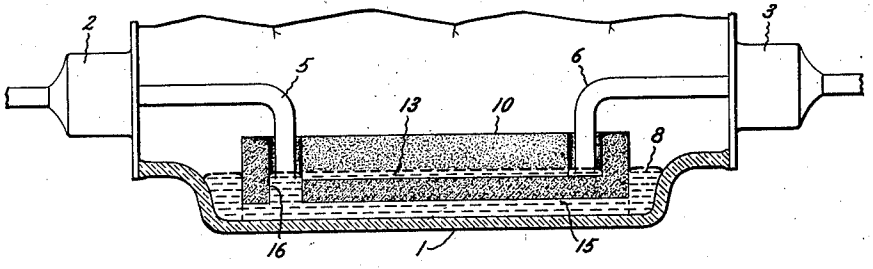


Fig. 4.

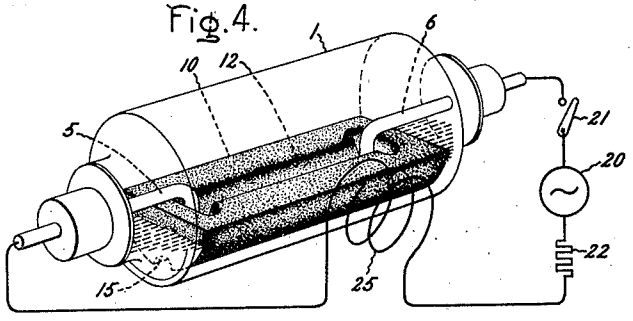
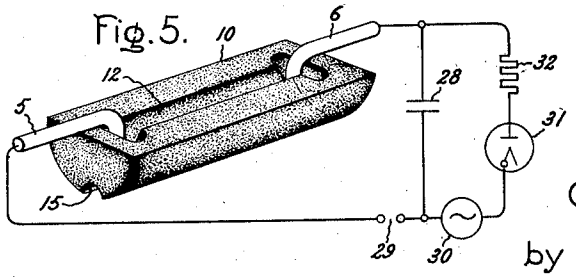


Fig. 5.



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HIGH INTENSITY LIGHT SOURCE

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Application March 26, 1938, Serial No. 198,288

4 Claims. (Cl. 176—1)

The present invention relates to improvements in high intensity light sources, such for example, as the so-called photo-flash lamps used in photography.

It is a primary object of the invention to provide a type of photo-flash lamp which is self-renewing and which can be used repeatedly. In this connection, I employ a narrow thread of mercury or some other liquid conductor as a means of light production. Light is obtained by passing current through the thread sufficient to cause an exposive rupture or displacement of the same and the resultant creation of a temporary high intensity arc. The configuration of the lamp enclosure and the associated parts is such as to cause automatic restoration of the mercury thread after the arc is extinguished. Consequently, repetitive operation of the lamp is possible.

The features of novelty which I desire to protect herein are pointed out with particularity in the appended claims. The invention itself, together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the drawing, in which Fig. 1 represents one form of lamp suitably embodying the invention; Figs. 2 and 3 are respectively longitudinal and transverse sections of the device shown in Fig. 1; and Figs. 4 and 5 are more or less schematic diagrams illustrating various ways in which the energization of the lamps may be accomplished.

Referring particularly to Fig. 1, I have shown a lamp comprising an elongated envelope 1 constituted of a light-transmitting substance such, for example, as glass or quartz. The ends of the envelope, which are of reduced diameter, are closed by means of metal caps 2 and 3, sealed directly to the glass. These caps may be formed, for example, of a cobalt-nickel-iron alloy which is capable of being joined in strain-free relation to certain commercial glasses. The caps 2 and 3 serve to support terminals or electrodes 5 and 6 which extend inwardly of the envelope at its ends and provide lead-in connections by means of which current can be supplied to the lamp.

Within the envelope there is provided a quantity of a liquid conductor such, for example, as mercury, this liquid being shown at 8 in Fig. 2. Cooperating with the mercury, there is provided a body or trough 10 extending longitudinally of the envelope. This is preferably constituted of a refractory material, such as alumina or lava, which has been fired at a high temperature. It is provided on its upper surface with a longitudinally extending channel or groove 12 running between the terminal connections 5 and 6. The position of the channel 12 with respect to the lower wall surface of the envelope is so chosen that a thin thread of the mercury 13 is caused to accumulate in the channel. A second groove 15 provided in the bottom of the refractory trough, serves to retain a reserve supply of mercury which is in communication with the channel 12 through an opening 16 (Fig. 2).

In the use of the device, a current of high intensity is caused to pass through the mercury thread 13 by applying a suitable potential between the terminals 5 and 6. If the current is of sufficient magnitude, the magnetic field which it creates in the vicinity of the mercury thread may be such as to cause a sudden disruption or explosion of the thread, resulting in the production of a flash of very intense light. The light thus produced is comparable in intrinsic brilliancy with that produced by photo-flash lamps now commercially available.

The mercury which is displaced from the channel 12 will be vaporized or splashed so as to accumulate on the walls of the envelope 1. After the discharge is extinguished it will return to the lower portion of the envelope by the action of gravity. To the extent that it does not do so, it may be forced to recombine with the main body of mercury 8 by rotating the envelope so as to obtain a washing effect.

In order to assist in extinguishing the arc which is created by the disruption of the mercury thread, the envelope may be filled with an arc-interrupting gas such, for example, as hydrogen. In some cases, especially where the current supply is of such nature as to terminate the arc automatically after a brief period, it may be advantageous to employ other gases such, for example, as nitrogen or argon, which will serve to enhance the brightness of the light produced by the arc.

For energizing a device such as that so far described one may use a circuit such as that shown in Fig. 1. This includes a source of alternating current 20 at a voltage of, say, 110 volts and a switch 21 for controlling the application of such voltage to the lamp. A resistance 22 may be placed in series with the supply source 20 for limiting the current to an appropriate value. For a mercury thread having an average diameter of about $\frac{3}{16}$ of an inch the current should be at least 100 amperes and preferably on the order of 1,000 amperes.

An alternative mode of operating

the type described is indicated in Fig. 4 wherein parts corresponding to elements already described are indicated by similar numerals. In this case the energizing circuit for the lamp includes a magnetic coil associated with the lamp for producing a field transverse to the mercury thread; that is, to the groove 12. It is the function of the coil 25 to assist in disrupting the mercury thread upon passage of a strong current therethrough. It also assists in blowing out the arc formed after the mercury is thrown out of the groove 12.

In Fig. 5 a still different type of energizing circuit is shown. (In this case, only the parts of the lamp which comprise the trough 10 and the terminals 5 and 6 are illustrated.) Across the terminals of the lamp there is connected a condenser 28 in series with a spark gap 29. The condenser is charged to a desired potential by means of an alternating source 30 connected in series with a rectifier 31 and a current limiting resistance 32. The spark gap 29 may be set so that as the potential on the condenser 28 approaches its maximum value, a break-down will occur. Under these conditions a high intensity discharge will pass through the lamp and will cause sudden disruption of the mercury thread. As soon as the condenser is completely discharged, the resultant arc will automatically terminate.

While I have described my invention in connection with a particular embodiment thereof, it will be understood that numerous modifications may be made by those skilled in the art without departing from the invention. I, therefore, aim to cover in the appended claims all such equivalent variations as fall within the true spirit and scope of the foregoing disclosure.

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

1. A light source comprising an elongated glass envelope having inwardly extending terminal connections at each end thereof, a body of refractory material within the envelope and providing a narrow open channel extending longitudinally of the envelope, a quantity of mercury lying in said channel and contacting said terminal connections near the extremities of the channel, and lead-in conductors for said terminal connections capable of supplying sufficient current thereto to produce an explosive displacement of mercury from said channel, the configuration of said envelope and said body being such as to cause the mercury to return to the channel after displacement therefrom.

2. A self-renewing photo-flash lamp comprising a light-transmitting envelope, a quantity of mercury within the envelope but incompletely filling the same, a pair of terminal elements respectively contacting the mercury at spaced points thereof, means for confining the portion of the mercury between the said points to a restricted channel which is open to the interior of the envelope so as to permit rapid displacement of mercury therefrom, energizing connections for the lamp consisting solely of a pair of lead-in connections respectively associated with the said terminal elements, and an arc-suppressing gas within the envelope; the said lead-in connections being capable of carrying sufficient current to cause explosive displacement of the mercury from the said restricted channel at a rate calculated to result in intense light emission and the said envelope being of such configuration as to permit the liquid thus displaced to return readily to the channel.

3. A self-renewing photo-flash lamp comprising a light-transmitting envelope, a quantity of mercury within the envelope but incompletely filling the same, a pair of terminal elements respectively contacting the mercury at spaced points thereof, means for confining a portion of the mercury between the said points to a restricted channel which is open to the interior of the envelope so as to permit rapid displacement of mercury therefrom, energizing connections for the lamp consisting solely of a pair of lead-in connections respectively associated with the said terminal elements, the said lead-in connections being capable of carrying sufficient current to cause explosive displacement of the mercury from the said restricted channel at a rate calculated to result in intense light emission, and a magnetic structure outside the envelope for producing a magnetic field effective to facilitate the said displacement of the mercury, the configuration of the envelope being such as to permit mercury displaced from the channel to return readily thereto under the influence of gravity.

4. A self-renewing photo-flash lamp comprising a light-transmitting envelope, a quantity of a liquid conductor within the envelope but incompletely filling the same, a pair of terminal elements respectively contacting the liquid at spaced points thereof, means for confining a portion of the liquid between the said points to a restricted channel which is open to the interior of the envelope so as to permit rapid displacement of the liquid therefrom, and energizing connections for the lamp consisting solely of a pair of lead-in connections respectively associated with the said terminal elements; the said lead-in connections being capable of carrying sufficient current to cause explosive displacement of the liquid from the said restricted channel at a rate calculated to result in intense light emission and the said envelope being of such configuration as to permit the liquid thus displaced to return readily to the channel.

CHAUNCEY G. SUITS.