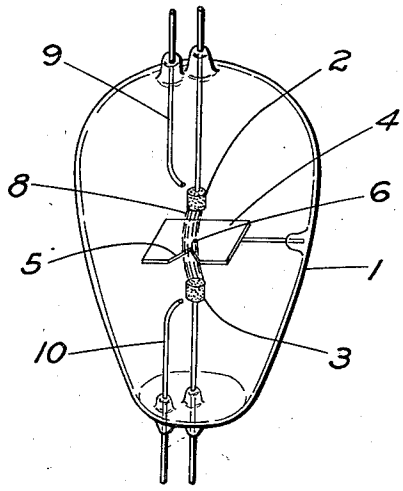
April 4, 1939. V. J. FRANCIS ET AL 2,152,992

ELECTRIC DISCHARGE DEVICE

Filed March 2, 1937



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Patented Apr. 4, 1939

2,152,992

UNITED STATES PATENT OFFICE

2,152,992

ELECTRIC DISCHARGE DEVICE

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Application March 2, 1937, Serial No. 128,686
In Great Britain March 3, 1936

2 Claims. (Cl. 176—122)

This invention relates to high-pressure mercury vapour electric discharge lamps of the type wherein the discharge column is of high brightness and the envelope is spherical or approximately spherical. The term "mercury" does not exclude the presence of substances, additional to mercury, whose spectra may contribute appreciably to the light emitted. The terms "high brightness" and "approximately spherical" will be defined hereinafter.

In a well-known type of high-pressure mercury-vapour lamp used for street-lighting and like purposes, the vapour pressure in full operation is between 1 and 2 atmospheres and the ratio of the power dissipated to the distance between the electrodes is between 15 and 30 watts/cm. (This ratio will be denoted hereafter by W/l.) The brightness of the discharge column is of the order of 200 candles per sq. cm. (The brightness means the maximum brightness measurable in a plane perpendicular to the discharge, and approximately bisecting it.) The column is substantially stable when the line between the electrodes is vertical or when the line is horizontal and a magnetic field is applied to prevent the column from bowing upwards; that is to say the column does not wander appreciably about its mean position.

But for some purposes, and especially when the lamp is to be used as a source for projection, greater brightness is desirable. It is known that a brightness of 10,000 candles per sq. cm. or more can be obtained by increasing sufficiently the vapour pressure in operation, thereby constricting the discharge further, so long as W/l is always great enough; pressures of 10 atmospheres up to 100 or even more have been proposed for this purpose. But when the pressure is increased, the column tends to become unstable and to wander about its mean position (even if this is vertical) under the intense convection currents. Such instability is most objectionable when the lamp is used as a source for optical projection; but it is objectionable in other circumstances; for the wandering may be accompanied by changes in the total light output.

Three ways of curing this instability have been proposed. In British patent specification No. 431,451, it has been proposed to enclose the discharge in a narrow tube, not more than 3.5 mm. in diameter. In British patent specification No. 434,919, it has been proposed to reduce the distance between the electrodes, so that W/l becomes more than 100 watt/cm., and possibly as much as 600 watt/cm. In our co-pending application Serial No. 128,687, filed March 2, 1937, it has been proposed to drive the discharge column by convective or other forces against refractory solid matter on one side of it, while the light is transmitted through a transparent portion of the envelope on another side of it.

The advantage of the first method is that the construction is simple; its disadvantage is that the tube, even if it is of quartz, has to be artificially cooled and even then may become obscured rapidly under the heat of the neighbouring discharge. The second avoids this disadvantage, while retaining the advantage; but the operating characteristics of the discharge are severely limited. The third avoids obscuration, but involves somewhat complicated constructions; moreover, if the lamp is to be operated with the line between the ends of the discharge vertical, the driving force has to be provided by a magnetic field.

The object of this invention is to provide an alternative method, also avoiding obscuration due to the heating of the envelope, and applicable over a wide range of characteristics, which is simpler, especially when the lamp is operated vertically, than the third method. The invention relates to those lamps in which the problem to which it is directed arises. Accordingly high brightness, though it always means a brightness considerably greater than 200 candles per sq. cm., does not necessarily imply a brightness as great as 10,000 candles per sq. cm.; for, though such brightnesses are attainable in lamps of relatively high wattage, they are not so easily obtainable in lamps of 100 watts; moreover, the brightness at which instability sets in varies considerably even in lamps of the same wattage. The term "high brightness" implies that the brightness is so great that if all solid matter were removed from the neighbourhood of the discharge (the pressure and the current remaining unchanged), the discharge would be unstable.

The term "spherical or approximately spherical" implies that the envelope is everywhere so distant from the discharge that the discharge is not rendered stable by its presence. Since the invention is more particularly useful when the distance between the electrodes is less than 20 mm., this condition will generally mean that the distance between the electrodes is not large compared with the cross section of the envelope. But it is to be understood that the distance between the electrodes is not to be so small and W/l so great that (as in the second method afore-

said) the discharge is stable in the absence of the feature characteristic of the invention.

According to the invention the said object is achieved by placing a solid body so that it intersects or approaches closely the straight line joining points at which the discharge column terminates on the electrodes, whereby, when the lamp is operated with the said line vertical, part of the discharge column is substantially displaced from the said line. The presence of such a body forcing the column to depart from its natural position is found to stabilise the column, so that it no longer wanders appreciably about a means position.

The solid body must not be symmetrical about the said line; preferably it approaches or intersects it from one side only. If the lamp is operated with the line vertical, the position of the body in a horizontal plane is immaterial so far as the operation of the discharge is concerned. But if the lamp is used for projection, the body will, of course, be turned away from the projecting apparatus and, in all circumstances will be formed and arranged so as to obscure as little as possible of the useful light. If the lamp is operated with the line horizontal, the body must approach or intersect the line from above, so that it prevents the column from rising appreciably above the said line, or forces it to lie below the line.

The solid body must be of highly refractory material and may be supported from the envelope. It may be an insulating material, such as thoria, or a metal, such as tungsten. If the distance between the electrodes is sufficiently small, a single blade of tungsten, intersecting the line between the electrodes at the centre of said line will suffice. The blade preferably has a notch so placed that the discharge column enters into it; the column is thereby prevented more certainly from wandering. If the body is conducting, it may be used, in known manner, as an auxiliary electrode to facilitate starting.

If the said distance is longer several such blades, which must be insulated from each other, may be used, spaced along the line between the electrodes. Alternatively a block of insulating refractory material may intersect, or approach very nearly, the said line over most of its length. But the invention is most useful when the distance is so short that a single blade can be used.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawing, which shows in perspective the parts of a device of the type specified relevant to the invention. Here 1 is a pear-shaped quartz envelope; 2, 3 are refractory electrodes of known type about 9 mm. apart. 4 is a tungsten blade, supported by a stalk from the envelope, having a notch 5 in its edge. The line joining the electrodes intersects the blade at the point marked 6 near the bottom of the notch. When the lamp is operated vertically as shown, the discharge column assumes the position indicated at 8, being substantially displaced from the line between 2 and 3. 9, 10 are starting electrodes behind the refractory running electrodes.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:

1. An electric vapor discharge lamp of the type adapted to operate with a constricted arc discharge comprising a sealed envelope containing a suitable gaseous atmosphere and having a pair of thermionic electrodes sealed therein on a vertical axis, a transverse refractory body intersecting said axis and eccentrically disposed with respect thereto, whereby said constricted discharge is forced to pass outwardly from a straight line path between said electrodes and is stabilized in position adjacent a particular portion of said refractory body.

2. An electric vapor discharge lamp of the type adapted to operate with a constricted arc discharge comprising a sealed envelope containing a suitable gaseous atmosphere and having a pair of thermionic electrodes sealed therein on a vertical axis, a transverse refractory body intersecting said axis and eccentrically disposed with respect thereto, said body having a notch therein whose bottom more closely approaches said axis than any other portion of the edge of said body, whereby said constricted discharge is forced to pass outwardly from a straight line path between said electrodes and is stabilized in position within said notch.

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