

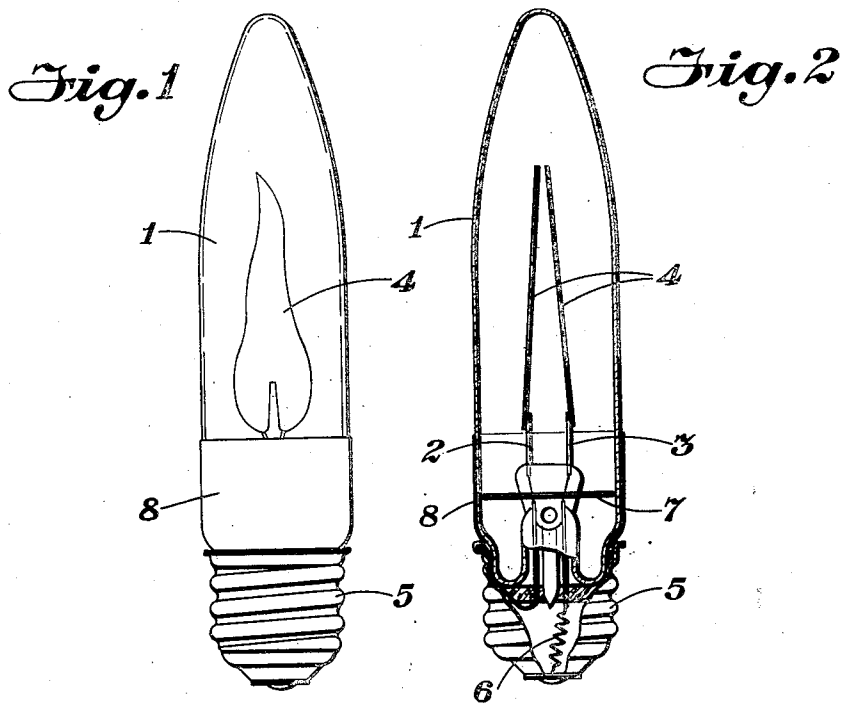
July 10, 1934.

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1,965,588

GASEOUS ELECTRIC DISCHARGE DEVICE AND METHOD OF PRODUCING THE SAME

Filed May 13, 1932



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UNITED STATES PATENT OFFICE

1,965,588

GASEOUS ELECTRIC DISCHARGE DEVICE AND METHOD OF PRODUCING THE SAME

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Application May 13, 1932, Serial No. 611,177

16 Claims. (Cl. 176—126)

The present invention relates to electric gaseous discharge devices, and particularly to electrodes therefor and the production thereof.

A particular object of the invention is to provide a discharge device of the cathode glow type which will operate throughout a long useful life on the usual commercial potentials of 110 volts, A. C. or D. C. Another object of the invention is to provide a novel process of producing a coating of low work function on the electrodes of a discharge device. Another object of the invention is to provide a process by which said electrodes may be uniformly activated, whereby the corona will be uniformly distributed over the surface of said electrodes. Still another object of my invention is to provide a process for producing an activating coating which can be conveniently and inexpensively applied to large electrodes of irregular shape. Still other objects and advantages of the invention will appear from the following detailed description thereof, or from an inspection of the accompanying drawing.

The invention consists in the novel discharge device, and in the novel steps of the process, as hereinafter set forth and claimed.

While gaseous electric discharge devices of the cathode glow type have been known for some time these devices have not gone into the extensive use that their many advantages would seem to merit, for the reason that so many difficulties have been encountered in the manufacture thereof, especially when electrodes of irregular shape were employed, that their cost has been prohibitive for many purposes. For successful use as a lamp it is essential that these devices should have a long useful life; that they should operate satisfactorily on lines having a nominal potential of 110 volts A. C. or D. C., despite severe voltage fluctuations; and that the corona should be uniform over the whole electrode surface. In addition to these characteristics it is obvious that the cost of production must be low, if these devices are to successfully compete with other types of light sources. None of the discharge devices heretofore produced has completely met all of these requirements, with the exception of devices having electrodes of such shape that they can be readily and uniformly heated by an induction furnace as a step in the process disclosed in my pending application, Serial Number 381,425, filed July 27, 1929. I have now discovered, however, a novel method of treating the electrodes of gaseous discharge devices which can be carried out with equal ease regardless of electrode shape or size, so that this novel process is singularly adapt-

ed to the production of lamps having electrodes of irregular shape, such as crosses, stars, flames, letters, numbers, insignia, or other desired symbols. My new process is also not only extremely inexpensive, but it also results in a device having a uniform corona over the entire electrode surface and a breakdown potential of the order of 45 volts A. C., which is obviously sufficiently low for satisfactory use on commercial circuits having a nominal potential of 110 volts A. C. or D. C., even though the voltage regulation of these circuits be extremely poor. My new device also has a useful life of several thousand hours, so that it fully meets all the requirements of a commercially successful glow lamp, as outlined above.

For the purpose of illustrating my invention I have shown one embodiment thereof in the accompanying drawing, in which

Fig. 1 is an elevational view of a cathode glow lamp having electrodes which simulate the flame of a candle, and

Fig. 2 is a sectional view of the same lamp.

The lamp shown in this drawing has a sealed envelope 1 of glass or any other suitable vitreous material, and is preferably highly transparent. The two inleads 2 and 3 are sealed into this envelope through a conventional stem press in the usual manner. Each of said inleads supports an electrode 4. Said electrodes can be of any desired metal, although I prefer to use nickel, and can have any desired configuration, but as here shown are in simulation of the flame of a candle. The tips of these electrodes are separated by only a millimeter or so, both to aid in the visual impression of a candle when the electrodes are viewed from an angle, and to lower the breakdown potential of the lamp. Each of these electrodes is coated in a novel manner which will be set forth in detail hereinafter. A conventional screw base 5 which is cemented to the envelope has the inlead 2 connected directly to the sleeve thereof, while the inlead 3 is connected to the tip of said base through a resistance 6 of the order of 1500-2000 ohms. A mica disc 7 is provided in some cases between the electrodes 4 and the point of sealing-in of the stem, this disc being conveniently supported by the stem press of said envelope 1. To aid in the simulation of a candle the lower part of the envelope 1 is preferably tubular and has a coating 8 of the color of wax thereon from the base 5 to a point almost even with the lower end of the electrodes 4. Said coating is conveniently formed of Duco or the equivalent, which may be sprayed on; or it may be produced by wrapping the envelope 1

with paper or the like. The envelope 1 contains any suitable gaseous atmosphere, such as has been heretofore used in cathode glow lamps, but for the purpose of simulating a candle I prefer to use neon containing about 0.4% or argon at a pressure of 30-35 m. m. of mercury.

In the manufacture of this device the electrodes 4 are preferably formed of sheet nickel, due to the fact that a nickel surface is more easily cleaned, but other metals such as iron, molybdenum, copper, or the like may be used if desired. The base metal may be nickel plated when metals other than nickel are used, if so desired. Said electrodes 4 are welded to the inleads 2 and 3, preferably in a reducing atmosphere in order to minimize the amount of oxide which must later be removed. The electrodes then have their surfaces roughened, since I have found that such a surface is more uniformly coated during the later steps and thus gives better results. This roughening may be accomplished in various ways, but I prefer to use chemical means. According to the preferred method the electrodes are first thoroughly washed in carbon tetrachloride, benzol, or other good solvent of grease and oil (a mixture of $\frac{2}{3}$ carbon tetrachloride and $\frac{1}{3}$ benzol being preferred), in order to avoid carrying such impurities into the subsequent baths. After drying the electrodes are dipped into a concentrated acid bath consisting of either nitric acid or a 50-50 mixture of nitric and citric acids for a period long enough to remove all the oxide and to initiate surface etching of the electrodes. This operation usually requires on the order of 15-30 seconds. This removal of the oxide from the electrodes and from any part of the inleads which may be subjected to bombardments is particularly important, since I have found that any remaining oxide is broken up during operation of the device, destroying the usefulness of the active electrode surface. The electrodes are then thoroughly washed in running water, after which they are placed in a 20% sulphuric acid bath and electrolytically etched by passing an alternating current of the order of 0.6 to 0.7 amperes per square centimeter therethrough for a period long enough to produce the desired rough surface. This usually requires from 30-60 seconds with the conditions set forth above. The principal object of this etching is to provide a chemically clean surface of such roughness that it will be wetted by and retain a considerable amount of a liquid as a uniform coating, and the various constants of current density, acid density, and the like are all chosen with this end in view. As an alternative to the foregoing method of cleaning and etching in a series of baths either the acid bath or the electrolysis alone may be utilized for the complete operation of cleaning and etching. The method described has given more consistent results, however, and is, therefore, preferred. After this removal of oxide and etching, regardless of how produced, the electrodes 4 and the adjacent parts of the inleads 2 and 3 are thoroughly washed in running water, and then finally rinsed in boiling distilled water in order to insure elimination of all traces of acids, salts and other soluble impurities from the surface thereof. The electrodes are then dried in an oven which preferably has a temperature of more than 200° C., but not enough to oxidize the nickel. This minimum temperature is chosen because it is substantially the maximum to which the electrodes are heated in any subsequent step, so that if there are any insoluble com-

pounds remaining on the electrodes which might otherwise might decompose with the evolution of gas at a later stage they will be decomposed at this time instead, when no possible harm can result.

The electrodes are then coated with the azide of one or more of the alkali or alkaline earth metals (which will be hereinafter referred to by the generic term "alkaline metals"), a mixture of the azide of an alkali metal with the azide of an alkaline earth metal being preferred. For example, in practice I use a mixture of barium azide and caesium azide, although either of these may be used to the exclusion of the other if desired. I have found, however, that this mixture of azides produces a better surface, having a more uniform corona and a longer life, than is produced by either thereof alone. In some cases, moreover, a mixture of alkaline earth azides, such as those of barium and strontium, may be used alone or with the caesium azide, while mixtures of the azide of the alkali metals, such as rubidium and caesium may likewise be employed, either alone or with the barium azide or with the aforesaid mixture of alkaline earth azides. Likewise other nitrogen compounds of these metals, such as the amids, which are readily reducible to the metal and the nitride, are useful in some cases. To produce the desired coating I preferably dip the electrodes into a water solution containing from 10% to 20% of barium azide to which there has been added 0.5% (by weight) of caesium azide. The percentage of barium azide is varied, within the above limits, in accordance with the ratio of electrode surface to envelope surface, the percentage of barium being decreased with increase in this ratio. This variation in the mixture is designed to compensate for the amount thereof which may be made unavailable by reason of combination with any traces if the water vapor evolved from the envelope during exhaust of the lamp which may come in contact with the electrodes, despite the precautions recited hereinafter. The electrodes are then carefully dried at room temperature, since this low temperature seems to give the best crystallization of the azides, producing a uniform surface in the finished lamp.

During these steps the electrodes 4 have preferably been left parallel in order to facilitate the drying operations. Hence the tips of the electrodes must now be moved to the desired position, by bending the ends of the supporting inleads, where a non-parallel arrangement is desired, as in the candle-lamp illustrated. The electrode assembly is then sealed into the enclosing envelope in a conventional manner, care being used to keep the electrodes 4 as much below 150° C. as possible during this sealing-in process, since any temperature much above 150° C. will produce an undesired change in the azide coating and cause failure of the process. The mica disc 7 is of material assistance in preventing the transfer of heat to the electrodes during this sealing-in, and hence is a desirable addition whenever the sealing-in operation requires a considerable amount of heat, or where the electrodes are close to the seal. It is to be understood, however, that this disc may be omitted in some cases, especially when the portion of the inleads which extends within the envelope is relatively long.

In case the electrodes have not been heated up to 130° C. during the sealing-in they are then heated to this temperature, either before or after exhaustion, with a resulting evolution of water vapor from the azide coating. The envelope 1 is

then exhausted (in case it has not been exhausted for the previous step) and while the vacuum therein is maintained the temperature of the envelope 1 and of the electrodes 4 is raised. When the electrodes reach a temperature of about 150° C. a copious evolution of nitrogen takes place during which most of the barium azide is reduced to the nitride, the electrodes then appearing black. Upon further heating of the electrode a further marked, but smaller, evolution of nitrogen occurs at about 180° C. at which time some of this nitride is reduced to metallic barium. I have found, however, that if any appreciable amount of the occluded gas and vapor which is driven from the envelope during the exhaust comes in contact with the electrodes after the decomposition of the azide has begun the active metal surface is changed. This change is evidenced by a whitish appearance of the surface, indicating the presence of barium hydroxide; by the fact that a long period of special treatment is required to produce a uniform corona; and by the fact that even after this long treatment the surface still has a work function of the order of 2.0 volts, whereas the desired surfaces has a work function of only 1.3 volts after a relatively short treatment. Hence I have found it to be essential to protect the electrodes from such evolved gases and vapors, and particularly from oxygen or water vapor, once the azide coating has begun to decompose. To attain this result I preferably heat the envelope 1 rapidly to a temperature (on the outside) of the order of 300° C. in an oven having a high ambient temperature of say 350° C. but a low radiant heat. The temperature of the electrodes 4 naturally lags behind that of the envelope 1, since they obtain their heat almost entirely by radiation, and during this initial heating these electrodes are not efficient radiation absorbing bodies, due to their light color. During this heating most of the occluded gas and vapor is, therefore, driven out of the envelope 1 before the electrodes reach the temperature, between 150° and 160° C. at which the decomposition of the barium azide begins, this occluded gas being removed as fast as evolved by a suitable exhaust system. As soon as the barium azide begins to decompose several modes of procedure are possible. The simplest of these is to leave the oven in place over the lamp, thus continuing to raise the temperature of both the envelope 1 and the electrodes 4. In this case the envelope 1 continues to give up occluded gas and vapor, but at the same time there is such a copious evolution of nitrogen from the coating on the electrodes 4 that a cloud of nitrogen is formed thereabout protecting said coating from the gas and water vapor given up by the envelope 1. As the electrode temperature rises the nitrogen evolution falls off, but does not cease, until at about 180° C. there is a second burst of nitrogen evolution from the coating, so that during this entire period the coating is effectively protected against contamination by the surrounding cloud of evolved nitrogen. As soon as the exhaust pumps begin to gain on this second nitrogen evolution, as evidenced by the decreasing pressure within the device, the oven is immediately removed. The temperature of the envelope 1 thereupon begins to fall, with an immediate cessation of the evolution of occluded gas therefrom. The electrodes 4 continue to receive radiant heat from the hotter envelope, however, so that the temperature thereof remains constant or even increases for a short interval, during which the nitrogen evolution

from the electrodes proceeds to completion in an envelope which is entirely free from contaminating gases or vapors. Once the electrodes have turned black, coincidental with the initial nitrogen evolution, the radiant heat absorption thereof greatly increases, which causes the electrode temperature to increase more rapidly than that of the envelope, thus minimizing the evolution of occluded gas after the electrode coating is sensitive to contamination thereby. This effect may be enhanced by increasing the radiant heat delivered within the oven, as by connecting additional resistance heaters, or by substituting radiant heaters which direct their rays upon said electrodes for other heaters, or by opening shutters which otherwise cut off said electrodes from the radiant heat of the oven heating units. As a further variation the oven may be removed as soon as the first evolution of nitrogen begins, allowing the envelope 1 to cool, with an immediate cessation of the evolution of occluded gas therefrom. Said envelope continues to heat the electrodes 4 by radiation, however, permitting the first stage of nitrogen evolution from the coating thereon to proceed to completion. The oven is thereupon replaced about the envelope 1 to further raise the electrode temperature to produce the second stage of the nitrogen evolution described above. During this continued heating the relative position of the electrodes with respect to the oven heaters may be changed to increase the radiant heat absorbed thereby and the amount of radiant heat emitted by the oven may likewise be increased by any of the expedients recited above. As a result of these changes, and of the increased receptiveness of the electrodes for radiant heat due to their black surface, it is possible to heat the electrodes to the desired higher temperature of approximately 180-200° C. without raising the envelope to a temperature above that to which it was heated before the initial decomposition of the azide began, so that no further occluded gas is evolved therefrom during this heating. As an alternative to this the envelope 1 may be shut off from the exhaust system as soon as nitrogen evolution first begins, allowing an appreciable nitrogen pressure, of the order of a centimeter or more of mercury, to build up. With such a concentration of nitrogen the occluded gas or vapor is so diluted that there is no appreciable contamination of the electrode coating. After the final evolution of nitrogen is complete the oven is raised and the accumulated gas is pumped out. Thus with any of these modes of procedure the contamination of the electrode surfaces by occluded gas and vapor, to an extent greater than can be readily compensated for by increase in the amount of barium, is effectively avoided. In any case, as soon as the vacuum is substantially complete following the final evolution of nitrogen from the barium compounds (the casium azide still being in its initial state) the lamp is allowed to cool and the desired gaseous atmosphere, such as the mixture of neon containing approximately 0.4% of argon at a pressure of the order of 30-35 m. m. of mercury, is admitted to the envelope 1, after which said envelope is sealed off in a conventional manner. For a candle lamp the foregoing gaseous atmosphere is especially desirable, since it not only produces a discharge which closely simulates the color of a candle flame, but also has a favorable effect upon the breakdown potential of the device.

The lamp is then activated, that is, the electrodes are put in the most sensitive condition, by

operating for about 30 seconds with an alternating current discharge of relatively high intensity, of the order of 10-20 milliamperes per square centimeter of electrode surface. During this activation of the caesium azide which lies on the surface of the electrode coatings is broken up by the discharge, yielding free metallic caesium, together with some caesium nitride, the evolved nitrogen being cleaned up either by absorption or by chemical combination with some of the barium. As soon as the gas evolution ceases the lamp is operated with a lower intensity discharge, of the order of 5-10 milliamperes per square centimeter of electrode surface, for a longer period or until the corona has spread uniformly over the entire electrode surface. This operation may require several minutes, and in some cases is made intermittent in order to avoid excessive heating of the electrodes. The lamp is then based and again operated on normal voltage for several hours, or until the electrode surface has become stable, as evidenced by its electrical characteristics and by the uniform corona on the surface thereof.

A lamp so produced has a breakdown potential of the order of 45 volts A. C. This low breakdown potential is due to the presence of the caesium, and persists only so long as there is caesium present on the surface. But whereas all previous caesium coatings have been notoriously short lived, my novel coating persists for at least several thousand hours with a discharge of the order of 2 milliamperes per square centimeter of electrode surface. This unusually long life is due to two things. First the bond between the caesium and the base metal is unusually strong when the caesium is produced thereon by my novel method, as evidenced by its low sputtering rate; and secondly there is a reserve of caesium azide present below the surface, this reserve gradually breaking up during operation of the device with a resulting constant replenishment of the metallic caesium on the surface. After the caesium is exhausted, however, which occurs only after several thousand hours of operation, the device will still operate on 110 volts A. C. or D. C., since the breakdown potential rises only to about 70 volts A. C., due to the barium surface still remaining. This new breakdown potential then remains virtually constant until the barium surface is likewise exhausted, after many thousand hours of operation. As a result my novel device will operate satisfactorily on any commercial source of 110 volts A. C. or D. C. for many thousand hours with a current density of the order of 2 m. a. per square centimeter of electrode surface.

While I have described a specific embodiment to illustrate my invention it is to be understood that it is not limited thereto. For example, I find that lamps having other electrode shapes, such as stars, crosses, letters, or other symbols, may be easily produced by my new process. Nor is my invention limited to the exact steps of the process hereinbefore described, it being understood that various omissions, substitutions and changes may be made therein by those skilled in the art without departing from the spirit of my invention. For example, other technique than that described may be obviously be employed to prevent the evolution of gas from the envelope walls after the final reduction of the electrode coating has begun. The relative amounts of ambient and radiant heat may be controlled to produce this result; or the heating of the envelope may be stopped before the electrode even approaches the critical temperature of 156° C. and the electrodes

then further heated by the use of a highly radiant heater or an induction furnace without further heating of the envelope. Various other expedients will doubtless suggest themselves to skilled workers in the art, all of which are believed to lie within the scope of the present invention, as set forth in the appended claims. In any case, however, it is essential that the final reduction of the electrode coating, when caesium is any part thereof, should take place while the inside wall of the envelope 1 is at a temperature of from 200-250° C., since at this temperature the evolved caesium will neither deposit on nor reduce the vitreous envelope.

I claim as my invention:

1. The method of producing an electric gaseous discharge device which comprises coating the electrodes thereof with a decomposable nitrogen compound of an alkaline metal, decomposing said compound to the nitride, and then further decomposing a portion of said nitride to the metal without exposing said electrodes to deleterious gases, evacuating the evolved gas, admitting a desired gaseous atmosphere to said device, and sealing-off said device.

2. The method of producing an electric gaseous discharge device which comprises coating the electrodes thereof with the azide of an alkaline metal, sealing said electrodes into a suitable envelope, evacuating said envelope, heating said envelope to drive occluded gas and vapor therefrom and heating said electrodes to decompose said azide, discontinuing the heating of said envelope before the decomposition of said azide is complete and availing of the heat stored therein to finish said decomposition, filling said envelope with a desired gaseous atmosphere, and then sealing-off said envelope.

3. The method of producing an electric gaseous discharge device which comprises coating the electrodes thereof with the azide of an alkaline metal, sealing said electrodes into a suitable envelope, evacuating said envelope, heating said envelope to drive occluded gas and vapor therefrom and heating said electrodes to the temperature at which said azide decomposes to a nitride, closing said envelope as soon as gas evolution begins from said azide, discontinuing said heating as soon as said gas evolution is ended, thereafter exhausting said envelope, refilling with a desired gaseous atmosphere, and sealing-off said envelope.

4. The method of producing a gaseous electric discharge device which comprises coating the electrodes thereof with the azide of an alkaline metal, sealing said electrodes into a suitable envelope, evacuating said envelope, heating said envelope to a temperature sufficient to drive out substantially all occluded gas and vapor while maintaining said electrodes at a temperature below the decomposition temperature of said azide, and then heating said electrodes to the decomposition temperature of said azide while maintaining said envelope at a temperature which does not exceed that to which it has been previously heated, evacuating the evolved gas, admitting a desired gaseous atmosphere into said envelope, and thereafter sealing-off said envelope.

5. The method of producing an electric gaseous discharge device which comprises coating the electrodes thereof with the azides of two different alkaline metals, decomposing at least one of said azides without exposing said electrodes to deleterious gases, evacuating the

evolved gas, admitting a desired gaseous atmosphere to said device, and sealing-off said device.

6. The method of producing an electric gaseous discharge device which comprises coating the electrodes with a mixture of the azide of an alkaline earth metal and the azide of an alkali metal, decomposing the azide of the alkaline earth metal without exposing said electrodes to deleterious gases, evacuating the evolved gas, admitting a desired gaseous atmosphere to said device, sealing-off said device, and producing a discharge between said electrodes to decompose the surface particles of said azide of an alkali metal.

7. The method of producing a gaseous electric discharge device which comprises coating the electrodes thereof with a mixture of barium azide and caesium azide, sealing said electrodes into a suitable envelope, evacuating said envelope, heating said envelope to a temperature sufficient to drive out substantially all occluded gas and vapor while maintaining said electrodes below 150° C. and then heating said electrodes to 180° C. while maintaining the space about said electrodes substantially free of contaminating gas and vapor, evacuating the evolved gas and vapor, admitting a desired gaseous atmosphere to said envelope, and sealing-off said envelope.

8. The method of producing a gaseous electric discharge device which comprises chemically etching the electrodes of said device to remove all oxide and produce a rough surface, coating said electrodes with a mixture of barium azide and caesium azide, sealing said electrodes into a suitable envelope while maintaining said electrodes below 150° C., evacuating said envelope, heating said envelope to a temperature above 200° C. to drive out occluded gas and vapor while maintaining said electrodes below 150° C. and then heating said electrodes to 180° C. while maintaining the space about said electrodes substantially free of contaminating gas and vapor, evacuating the evolved gas and vapor, admitting a desired gaseous atmosphere to said envelope and then sealing-off said envelope.

9. The method of producing a gaseous electric discharge device which comprises chemically etching the electrodes of said device to remove all oxide and produce a rough surface, coating said electrodes with a mixture of barium azide and caesium azide, sealing said electrodes into a suitable envelope while maintaining said electrodes below 150° C., evacuating said envelope, heating said envelope to a temperature above 200° C. to drive out occluded gas and vapor while maintaining said electrodes below 150° C. and then heating said electrodes to 180° C. to decompose the barium azide to the metal and the nitride while maintaining the space about said electrodes substantially free of contaminating gas and vapor, evacuating the evolved gas and vapor, admitting a desired gaseous atmosphere to said envelope, sealing-off said envelope, operating said device for a short time with a discharge of the order of 20-30 m. a. per square centimeter to reduce the surface particles of the caesium azide, and then operating for a longer time with a discharge of less intensity to produce a uniformly active surface on said electrodes.

10. The method of producing a gaseous electric discharge device which comprises removing

all oxide from the electrodes of said device, coating said electrodes with the azide of an alkaline metal, sealing said electrodes into a suitable envelope, evacuating said envelope, heating said envelope to a temperature sufficient to drive out substantially all occluded gas and vapor while maintaining said electrodes below the decomposition temperature of said azide and then heating said electrodes to a temperature sufficient to decompose said azide to the alkaline metal while maintaining the space about said electrodes substantially free of contaminating gas and vapor, evacuating the evolved gas, admitting a desired gaseous atmosphere to said envelope, and sealing-off said envelope.

11. The method of producing a gaseous electric discharge device which comprises removing all oxide from the electrodes of said device, coating said electrodes with the azide of an alkaline metal, sealing said electrodes in to a suitable envelope while maintaining said electrodes at a temperature below the decomposition temperature of said azide, evacuating said envelope, heating said envelope to a temperature sufficient to drive out substantially all occluded gas and vapor while continuing to maintain said electrodes below the decomposition temperature of said azide and then heating said electrodes to a temperature sufficient to decompose said azide to the metal while maintaining the space about said electrodes substantially free of contaminating gas and vapor, evacuating the evolved gas, admitting a desired gaseous atmosphere to said envelope, and sealing-off said envelope.

12. The method of producing light from an electric gaseous discharge device having a coating of caesium and caesium azide on at least one of the electrodes thereof which comprises applying a low potential between the electrodes of said device to produce a luminous discharge therebetween, and availing of said discharge to continuously reduce some of said caesium azide to the metal in order to permit continued maintenance of said discharge at said low potential.

13. An electric gaseous discharge device comprising a sealed envelope, a gaseous atmosphere therein, electrodes sealed into said envelope, and a coating on at least one of said electrodes, said coating comprising a mixture of an alkaline earth metal and an alkali metal.

14. An electric gaseous discharge device comprising a sealed envelope, a gaseous atmosphere therein, electrodes sealed into said envelope, and a coating on at least one of said electrodes, said coating comprising a mixture of barium and caesium.

15. An electric gaseous discharge device comprising a sealed envelope, a gaseous atmosphere therein, electrodes sealed into said envelope, and a coating on at least one of said electrodes, said coating comprising a mixture of barium, barium nitride and caesium azide, with metallic caesium on the surface thereof.

16. An electric gaseous discharge device comprising a sealed envelope, a gaseous atmosphere therein, electrodes sealed into said envelope, and a coating on at least one of said electrodes, said coating comprising an alkaline nitride having an alkali metal on the surface thereof.

TED E. FOULKE.

CERTIFICATE OF CORRECTION.

Patent No. 1,965,588.

July 10, 1934.

TED E. FOULKE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, line 43, for "complete" read compete; and line 85, for "uses" read use; page 2, line 18, for "surfaces" read surface; page 4, line 9, for "absorption" read adsorption; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of September, A. D. 1934.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.