Oct. 14, 1941. G. A. FREEMAN 2,259,105

AUTOMATIC EXHAUST OF HIGH PRESSURE LAMPS

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Fig. 1.

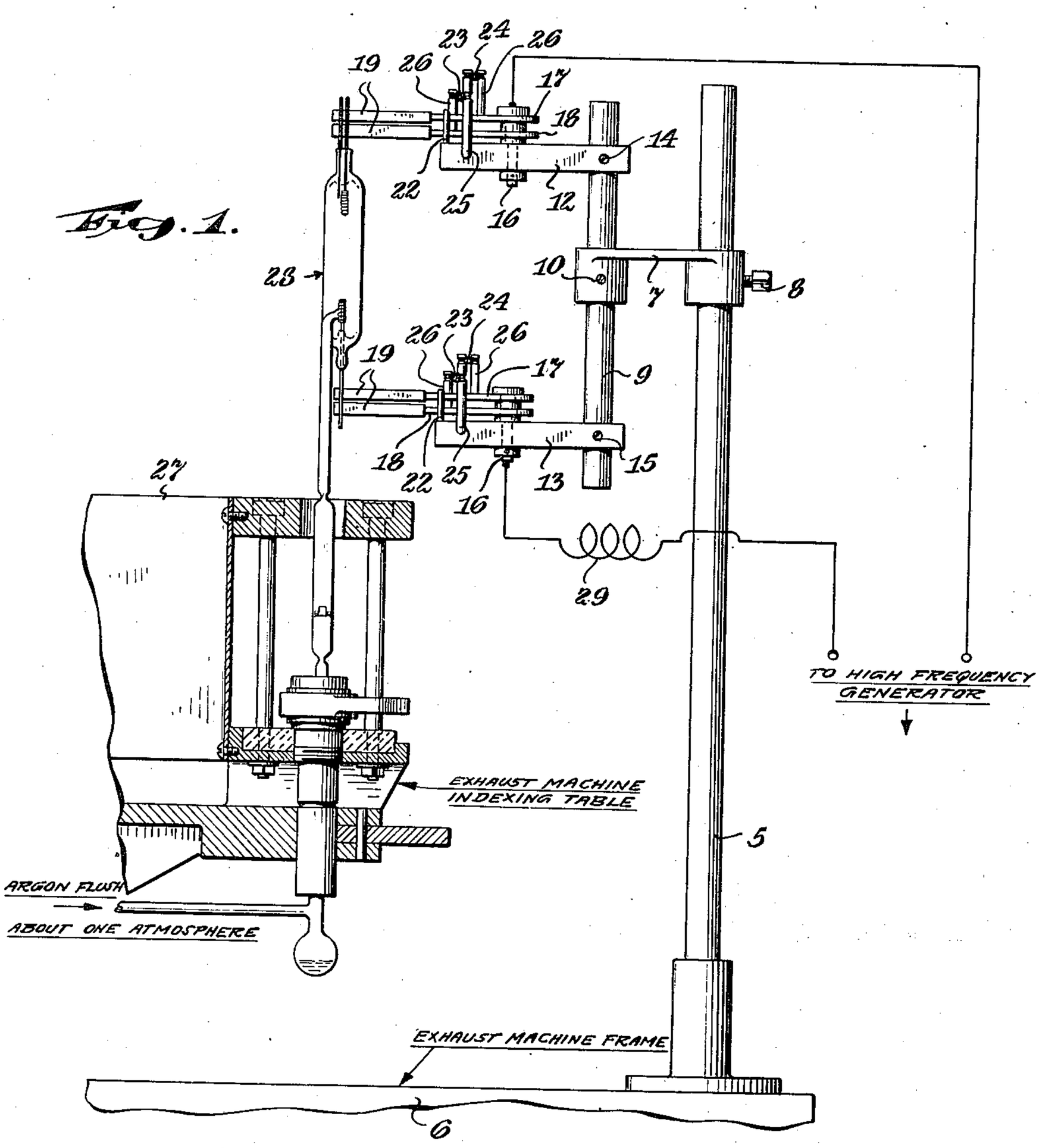
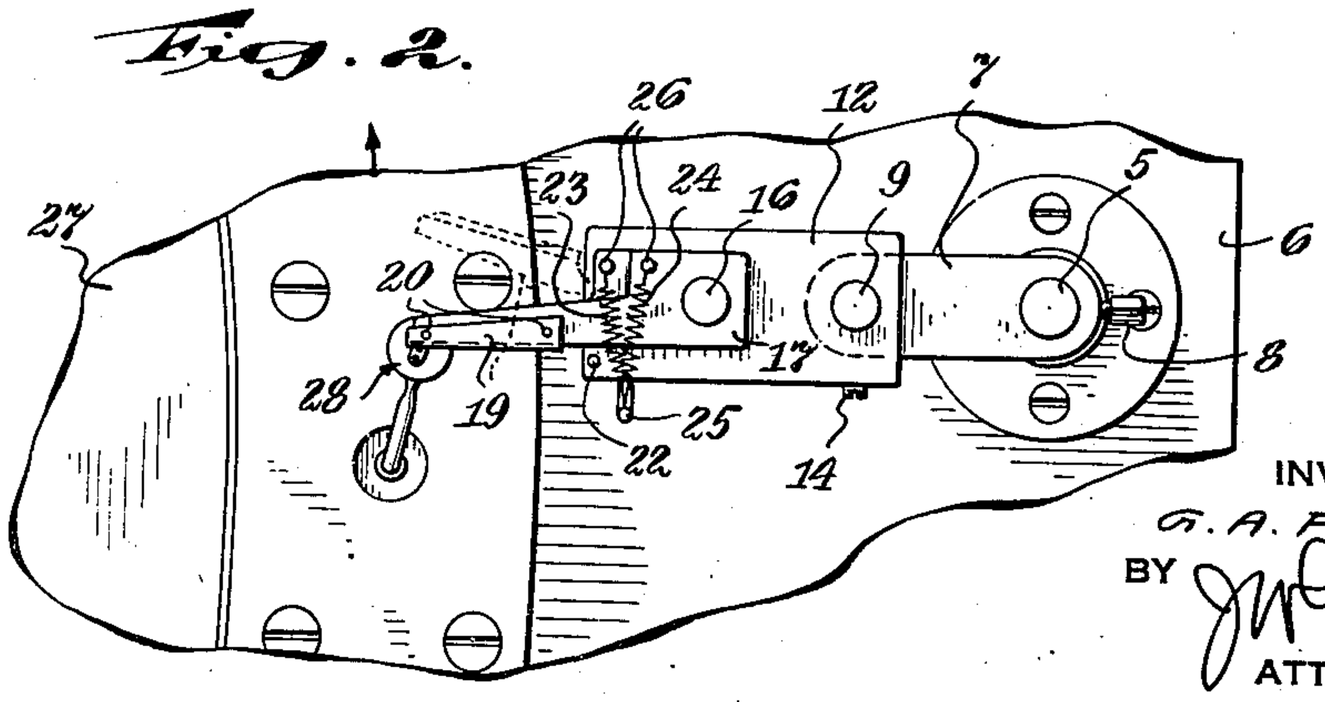


Fig. 2.



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AUTOMATIC EXHAUST OF HIGH PRESSURE LAMPS

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8 Claims. (Cl. 176—2)

The present invention relates to the evacuation of discharge devices and more particularly to the method and apparatus for automatically exhausting lamps of the high pressure mercury type.

It is customary in the manufacture of mercury vapor lamps to automatically exhaust the same on a machine provided with a turn-table which periodically indexes the lamp to a separate position for each step of the exhaust process. In each position the index time is necessarily of as short a duration as possible in order to obtain quantity production and maximum economy of manufacture.

It is necessary, as is well known in the art, to completely degasify the electrodes during the exhaust process. This is customarily done by filling the lamp with an inert gas at low pressure of about 20 millimeters and applying sufficient electrical energy to the tube to cause a discharge between the electrodes while the lamp is connected to the exhaust pump. The heat generated by the discharge drives off the occluded gases from the electrodes, which are then withdrawn by the exhaust pump. This method of exhaust is objectionable because sputtering and vaporization of the electrodes is high at low pressure.

A further method is to heat the electrodes by high frequency induction during one step of automatic machine exhausting. Although such exhaust apparatus and method operates successfully for most types of lamps, it has heretofore been very inefficient in connection with high pressure lamps of the capillary type. This is due to the fact that the electrodes, which are sealed into each end of a quartz envelope, are of exceptionally small area and hence cannot conveniently be heated by high frequency induction heating to a sufficiently high temperature to completely degasify the electrodes with available apparatus.

It is accordingly an object of the present invention to provide an automatic exhausting apparatus wherein succeeding lamps are so positioned that the electrodes can be substantially completely degasified during the exhaust process.

Another object of the present invention is the provision of an apparatus wherein succeeding lamps of the high pressure mercury vapor type can be automatically heated to a sufficiently high temperature to obtain substantially complete degasification of the electrodes.

Another object of the present invention is the provision of an automatic exhausting apparatus wherein sufficiently high current is supplied to the lamp to heat the electrodes to a high temperature so as to liberate occluded gases while the lamp is connected to the exhaust pump in order to completely degasify the electrodes without endangering the operation of the machine due to the high current employed.

Another object of the present invention is the provision of a method of exhausting discharge lamps of the high pressure type wherein the lamps are successively positioned automatically so that the small area electrodes of such lamps are more completely degasified than has been heretofore possible with automatic exhaust machines.

Still further objects of the present invention will become obvious to those skilled in the art by reference to the accompanying drawing wherein:

Fig. 1 is an elevational view of the apparatus of the present invention as forming a part of the customary indexing exhaust machine, and

Fig. 2 is a plan view of the apparatus as shown in Fig. 1.

Referring now to the drawing in detail, the apparatus shown, and which performs the steps of the present method, comprises a standard 5 extending upwardly from the exhaust machine frame 6 and provided with a bracket 7 which is adjustable relative to the standard and held in place by a set screw or the like 8. The bracket 7 includes an adjustable rod or shaft 9 parallel to the standard 5, which is likewise held in place by a set screw 10, and a pair of adjustable arms 12 and 13 are secured at the desired position adjacent each end of the shaft 9 by set screws or the like 14 and 15, respectively.

These arms 12 and 13 are formed of suitable insulating material such as Bakelite, hard rubber, or the like, and are of identical construction. As can be seen in the figures, a bolt 16 passes through the arm which serves as a terminal for a conductor leading from a source of high frequency electrical energy and at the same time retains a pair of fingers 17 and 18 in a position where their free ends protrude beyond the arms, with the latter being provided with contact terminals 19 of carbon or the like, secured by rivets 20 (Fig. 2) or other suitable fastenings to the fingers.

These fingers 17 and 18 are disposed one above the other and are normally held against a stop 22 (Fig. 2) by the tension of a pair of coil springs

23 and 24 secured to a stationary pin 25 carried by the arms 12 and 13 and a similar pin 26 secured to the respective arms. As previously mentioned, the apparatus above described is attachable to, and thus becomes a part of, an indexing exhaust machine, such as shown and described in the copending application of O. R. Wollentin and F. T. May, Ser. No. 294,468, filed Sept. 12, 1939, and assigned to the same assignee as the present invention, as well as the apparatus such as shown in Patent No. 1,651,865, issued December 6, 1927, to H. D. Blake et al. and Patent No. 1,819,597, issued August 18, 1931, to C. Eisler.

Since such exhaust machine per se forms no part of the present invention, it is believed unnecessary that the machine be shown and described in detail herein. It should suffice to say that the indexing table, shown generally at 27, periodically rotates in the direction indicated by the arrow in Fig. 2 to successively position a high pressure mercury lamp 28 in a predetermined location while the lamp is supported by the exhaust tubulation as shown in Fig. 1.

When in this position, the leading-in wires for the electrodes of the lamp 27 make a brushing contact with the respective fingers 17 and 18 of the arms 12 and 13, and since these are electrically connected to a source of high frequency electrical energy carried by the indexing table, the lamp is energized by closure of a switch when desired and during the introduction of an inert gas into the envelope through the gas port. In this position of the indexing exhaust apparatus it is essential in order to properly degasify the electrodes that they be heated very hot. A high current will raise the temperature of the electrodes sufficiently high in a very short period of time, but at the gas pressures of the inert gas heretofore used of about 20 millimeters, sputtering of the electrodes with attendant blackening of the envelope results.

By the exhaust method of the present invention this difficulty is overcome by the utilization of a gas pressure for the argon or similar gas as high as approximately one atmosphere (760 mm.) which enables currents to be passed of from five to ten times normal lamp current. This accordingly heats the electrodes to a very high temperature because sufficient energy is supplied thereto in the short indexing time, and quickly cleans up the impurities without sputtering and blackening of the envelope.

The use of such high argon pressure during exhaust presents a problem in starting the arc discharge, since several thousand volts are required, and if sixty cycle current is employed, such would constitute a hazard for those working around the exhaust machine. However, such hazard is eliminated by employing high frequency current for initiating and sustaining the discharge between the electrodes, which high frequency power source is carried by the indexing machine for inductively heating the electrodes of other larger type lamps during one of the exhaust steps, and a choke coil 29 is connected in series with the source and lamp to set the arcing current.

As the lamps are indexed to the position shown, they may vary in height due to variations in machine ports or length of exhaust stem, and in order to insure contact with the lamp leads, it was found preferable to employ two independent fingers at varying height, which thus gives positive electrical contact to enable arcing of the lamp. Moreover, the carbon facings on the contact fingers eliminate the possibility of the lamp leads welding to the fingers, thus allowing the lamp to pass by the latter which yield sufficiently, and then return to their normal position by virtue of the coil springs.

It thus becomes obvious to those skilled in the art that an apparatus and method of exhausting lamps of the high pressure mercury vapor type is herein provided which enables complete degasification of the electrodes during the short indexing time of an exhaust machine. Moreover, all possibility of high voltage hazards is eliminated, thus protecting the machine operator, and the apparatus when attached becomes an integral part of the exhaust machine so that succeeding lamps are treated to degasify the electrodes as a part of the exhaust during fabrication of the lamp.

Although one specific embodiment of the present invention has been shown and described, it is to be understood that other modifications thereof may be made without departing from the spirit and scope of the appended claims.

I claim:

1. The method of degasifying the electrodes of a discharge lamp of the high pressure mercury vapor type which comprises filling the lamp while on an automatic exhaust machine with an inert gas at a relatively high pressure, and applying a high voltage high current to the electrodes to initiate and sustain an arc discharge therebetween to rapidly raise the electrodes to a high temperature.

2. The method of degasifying the electrodes of a discharge lamp which comprises filling the lamp while on an automatic exhaust machine with an inert gas at a pressure of the order of one atmosphere, and applying a high frequency current to the electrodes to initiate and sustain an arc discharge therebetween to rapidly raise the electrodes to a high temperature and drive off occluded gases.

3. The method of degasifying the electrodes of a discharge lamp in the short indexing time of an automatic exhaust machine which comprises filling the lamp with an inert gas at a pressure of the order of one atmosphere, and applying a high voltage high current to the electrodes of sufficient magnitude to ionize the gas and initiate and sustain an arc discharge between said electrodes to rapidly heat the same to a high temperature to drive off occluded gases.

4. The method of degasifying the electrodes of a discharge lamp in the short indexing time of an automatic exhaust machine which comprises filling the lamp with an inert gas at a pressure of the order of one atmosphere, and applying a high voltage high current from a high frequency source to the electrodes to initiate and sustain an arc discharge therebetween to rapidly raise the electrodes to a high temperature and drive off occluded gases.

5. The combination with an automatic exhaust machine provided with an indexing table for successively disposing a high pressure discharge lamp in a predetermined position and having means for filling each successive lamp with an inert gas at a relatively high pressure, of a support carried by said exhaust machine, means secured to said support engaging the leading-in conductors for the electrodes of each successive lamp when disposed in said predetermined position, and means for supplying a high current to said last-mentioned means when in engagement with the leading-in conductors of each suc-

ceeding lamp to initiate and sustain an arc discharge between the electrodes of the lamp to rapidly heat the electrodes to a high temperature and drive off occluded gases.

6. The combination with an automatic exhaust machine provided with an indexing table for successively disposing a high pressure discharge lamp in a predetermined position and having means for filling each successive lamp with an inert gas at a relatively high pressure, of a support carried by said exhaust machine, a bracket secured to said support and provided with contact terminals engaging the leading-in conductors for the electrodes of each successive lamp when disposed in said predetermined position, and means for supplying a high current to said contact terminals when in engagement with the leading-in conductors of each succeeding lamp to initiate and sustain an arc discharge between the electrodes of the lamp to rapidly heat the electrodes to a high temperature and drive off occluded gases.

7. The combination with an automatic exhaust machine provided with an indexing table for successively disposing a high pressure discharge lamp in a predetermined position and having means for filling each successive lamp with an inert gas at a relatively high pressure, of a support carried by said exhaust machine, a bracket secured to said support and provided with spring pressed contact terminals engaging the leading-in conductors for the electrodes of each successive lamp when disposed in said predetermined position and said contact terminals being yieldable so as not to impair movement of each lamp to a further indexing position of said machine, and a source of high frequency current connected to said contact terminals for initiating and sustaining an arc discharge between the electrodes of each successive lamp to rapidly heat the electrodes to a high temperature and drive off occluded gases.

8. The combination with an automatic exhaust machine provided with an indexing table for successively disposing a high pressure discharge lamp in a predetermined position and having means for filling each successive lamp with an inert gas at a relatively high pressure, of a support carried by said exhaust machine, a bracket secured to said support and provided with spring pressed contact terminals engaging the leading-in conductors for the electrodes of each successive lamp when disposed in said predetermined position and said contact terminals being in superimposed pairs to insure engagement with the leading-in conductors for each of the electrodes and being yieldable so as not to impair movement of each lamp to a further indexing position of said machine, and a source of high frequency current connected to each pair of contact terminals for initiating and sustaining an arc discharge between the electrodes of each successive lamp to rapidly heat the electrodes to a high temperature and drive off occluded gases.

GEORGE A. FREEMAN.