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1,647,618	11/1927	Gustin	316/30 X
1,851,360	3/1932	Jacobsen	316/30 X
3,294,468	12/1966	Emdy et al.	316/24
3,484,146	12/1969	Meijer et al.	316/20

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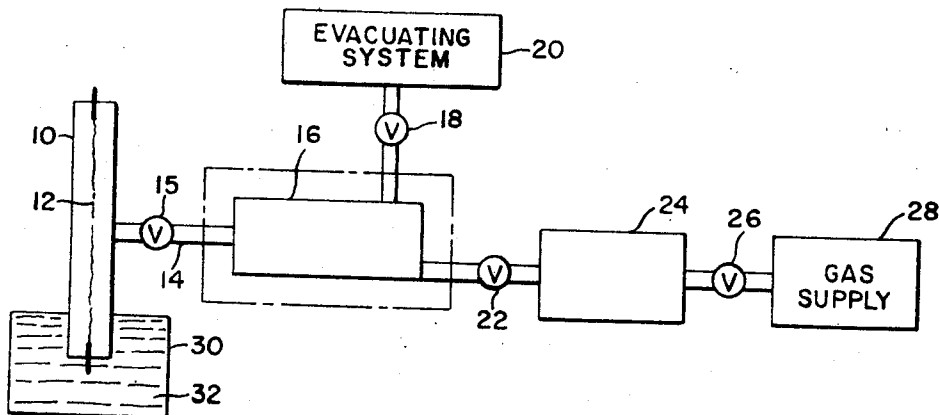
[54] **METHOD OF BASING A HALOGEN CYCLE**
INCANDESCENT LAMP
 8 Claims, 2 Drawing Figs.

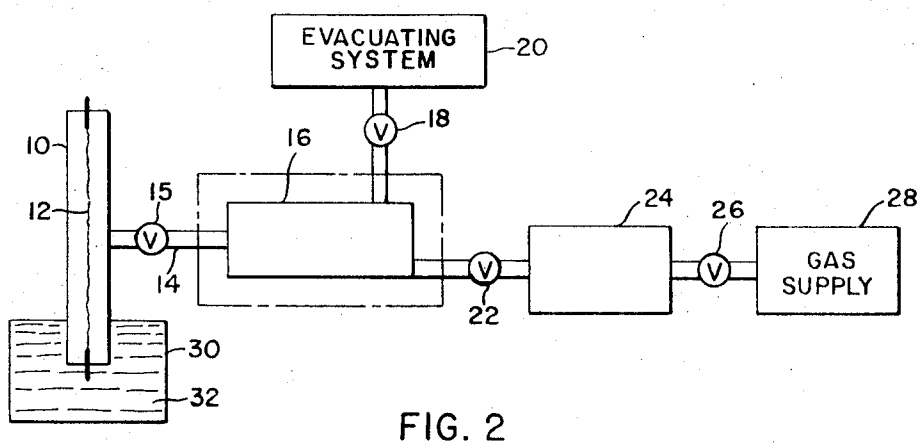
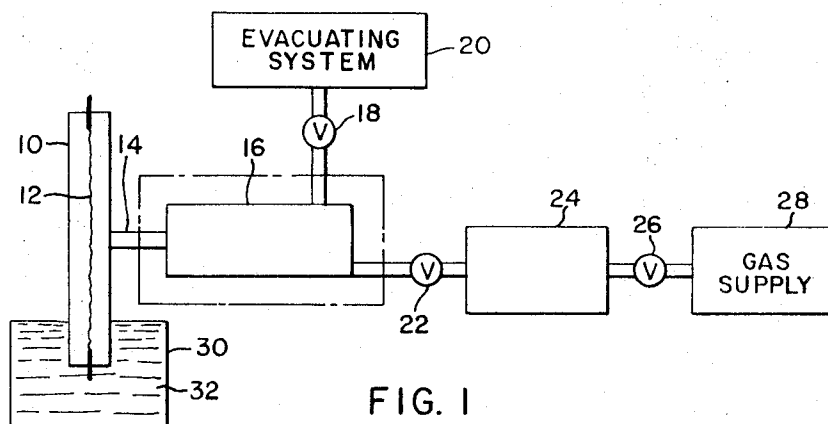
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[56] **References Cited**
UNITED STATES PATENTS

1,565,579 12/1925 Mac Rae 316/30 X

ABSTRACT: A method of dosing an incandescent lamp with predetermined amounts of halogen and inert fill gas. The lamp and an interconnecting chamber are evacuated. A common chamber contains a mixture of halogen and inert gas at predetermined partial pressures. The halogen and fill gas are simultaneously transported from the common chamber to the lamp and interconnecting chamber to establish predetermined partial pressures of halogen and inert gas in the lamp and interconnecting chamber. The lamp is then cooled below the condensation point of the halogen to condense the halogen in the lamp, and the cooling of the lamp also causes an increased amount of the fill gas to be dosed into the lamp. The lamp is then sealed off from the interconnecting chamber.





WITNESSES

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METHOD OF BASING A HALOGEN CYCLE INCANDESCENT LAMP

BACKGROUND OF THE INVENTION

The use of tungsten-halogen cycle incandescent lamps is now well known in the art. A continuing problem in this field has been to provide a method of rapidly dosing the lamps with an accurate amount of the halogen element. The reactive nature of the halogen elements presents transport and handling problems. It has also been discovered that such lamps should be desirably dosed with inert gas in excess of one atmosphere. Various dosing methods are taught and presently practiced in the art, and these include Japanese Patent Utility Publication SHO 38-21355, Audesse, U.S. Pat. No. 3,063,778, Wiley, U.S. Pat. No. 3,093,430 and Brundige, U.S. Pat. No. 3,208,812, the latter of which is owned by the present assignee.

In general the above-mentioned dosing methods are tedious and time consuming. It is desirable to be able to complete the dosing operation in as short a time as possible while insuring accuracy of dosing and prevention of contamination. The latest dosing techniques involve vapor transport mechanism for transporting the halogen. This vapor transport mechanism even when speeded up by cryogenic pumping is not an entirely satisfactory procedure, primarily because of the inherent problems of the vacuum technique with the long mean free transport period, and because of the reactivity of the halogen.

SUMMARY OF THE INVENTION

It is accordingly an object of the invention to provide a method which allows quicker and more accurate dosing of lamps, and which insures against reaction of the halogen.

It is another object of this invention to provide a simplified and efficient method for accurately supplying a predetermined amount of halogen and inert fill gas to an incandescent lamp.

It is still another object of the invention to provide a method for dosing the amount of halogen while providing a fill gas pressure of greater than one atmosphere.

It is a further object that such simplified method be readily adapted to rapid mass production techniques.

The aforementioned objects, and others which will become apparent as the description proceeds, are achieved by a method which comprises evacuating the lamp envelope and an interconnecting chamber which can be quickly connected to a source of halogen and inert fill gas. The admixed halogen and fill gas are maintained in a common chamber at predetermined partial pressures. The halogen and the fill gas are transported into the lamp and interconnecting chamber in predetermined amounts. At least a portion of the lamp is then cooled to a temperature below the condensation point of the halogen to condense substantially all of the halogen in the lamp and to cause substantially all of the fill gas to flow into said envelope. cooling temperature is preferably below the condensation point for the gas also, readily insuring retention of the fill gas in the lamp during sealing of the lamp from the interconnecting chamber or system. The fill gas in the lamp preferably being above one atmosphere at ambient temperature.

The method described above is inherently quicker than prior-art dosing methods, because by maintaining the fill gas at a relatively high partial pressure mixed in the common chamber with the halogen insures that when the evacuated lamp and interconnecting system are connected to the chamber the fill gas readily expands into the evacuated lamp and interconnected chamber carrying with it the halogen at a rate much quicker than if the halogen were being solely vapor transported in the evacuated space. The relatively high partial pressure of the inert fill gas also makes less stringent the purity problems which would be normally associated with a simple vacuum vapor transport technique.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a dosing system for practicing one embodiment of the method of the present invention; and

FIG. 2 is a modified dosing system for while valve another embodiment of the method of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS micromole micromole

The method of the present invention can best be described by reference to the figures. The partially fabricated lamp 10 shown in FIG. 1, is an incandescent lamp with a tungsten filament 12 and a vitreous envelope of quartz or high silica content vitreous material. The lamp 10 is connected via the exhaust tubulation 14 to a conventional hermetically sealable connector 16 which allows for quick connection and disconnection of the tubulation 14 to the evacuating and dosing system while providing a good hermetic seal with respect to the atmosphere. The connector 16 is connectable via valve 18 to the evacuating source 20. The connector is also connectable via quick opening valve 22 to chamber 24 which is in turn connected via tubulation and valve 26 to fill gas source 28. The chamber 24 has conventional temperature control means associated therewith. The chamber 24 contains an amount of iodine, typically several grams, which iodine supply is easily refilled upon exhaustion which would only be after a long period of continuous production.

In operation valve 26 is opened to allow a predetermined amount of argon into chamber 24. The chamber 24 is sealed and then brought to about 85° C., at which temperature in the 600 cc. volume chamber, a partial pressure of iodine of 20 Torrs is established and an argon partial pressure of about 800 Torrs. The volume of lamp 10 is typically about 3 cc., and the volume of the interconnecting chamber defined by the volume of the vacuum connector 16 and the tubulation 14 and the tubulation from valves 18 and 22 to the connector 16, and not including the lamp volume, is for example 5 cc.

In dosing a lamp, valve 18 is opened while valve 22 is closed to evacuate the lamp and the interconnecting chamber to a vacuum in the micron range, after which valve 18 is closed. Valve 22 is now opened for less than a second to transport the iodine and the argon into the partially fabricated lamp 10 and the interconnecting chamber. The lamp 10, or at least a portion thereof is cooled to a temperature below the condensation point of iodine. For example, one end of the lamp 10 is immersed in container 30, which preferably contains liquid nitrogen 32. This condenses the iodine in the lamp in amount, of for example, from 0.1 to 1.0 micromole per cc. of lamp volume. In the foregoing example 1.5 micromole of iodine was condensed in the lamp. When liquid nitrogen is used as the cooling medium and argon is the inert fill gas a substantial percentage of the argon in the lamp and interconnected system will also condense in the cooled portion of the lamp also. The lamp is then sealed in the usual manner by tipping off tubulation 14 at a point adjacent the lamp envelope. The resulting argon pressure when the lamp is removed from the cooling medium and returned to ambient temperature is about 2½ atmospheres. For repetitive dosings additional argon is added to chamber 24 from argon supply source 28 via valve 26.

While liquid nitrogen was suggested as the cooling medium in this specific example, this is principally because it allows for condensation of the argon to provide a final argon pressure of several atmospheres. In order to provide a fill gas pressure greater than one atmosphere in the lamp, the portion of the lamp must be cooled to a temperature low enough to either condense the fill gas, or at least to result in a substantial increase in the amount of the fill gas in the lamp, such as when nitrogen is used as the fill gas with liquid nitrogen cooling medium.

It is of course more convenient to have the fill gas as well as the halogen condensed during the sealing operation to insure accuracy of the dosing. Also, the lower the temperature of the

cooling medium the quicker will be the condensation of the halogen and the fill gas, and the quicker the dosing operation in general.

Of course the partial pressures of halogen and fill gas in chamber 24 can be readily varied, as well as the period during which valve 22 is opened to vary the amount of halogen and fill gas transported into the lamp and interconnecting chamber, and ultimately into the lamp. It is however desirable to maintain the fill gas partial pressure above one atmosphere, and to maintain the halogen at a temperature below its boiling point because of the reactivity of the halogen.

In another embodiment of the invention as shown in FIG. 2, a valve 15 is placed in the system between the exhaust tubulation 14 and the connector 16. After evacuating the lamp and the interconnecting chamber to several microns valve 15 is closed, and valve 22 is opened to transport the iodine and argon which are maintained in chamber 24 at the same partial pressures as indicated in the first embodiment. When a predetermined amount of halogen and argon are transported into the known volume of interconnecting chamber 16, valve 22 is closed. A portion of lamp 10 is then cooled by immersion in the liquid nitrogen 32 and valve 15 is opened to transport substantially all of the iodine and argon into the lamp envelope. The lamp is then sealed by tipping off tubulation 14 adjacent the lamp envelope as before. Since the iodine and argon are initially only transported into the interconnecting chamber and not the lamp, this means that valve 22 is to be left open for a period which is long enough to transport in the smaller volume the same amounts of argon and iodine as in the first embodiment.

The narrowest constriction in the dosing system between the halogen and fill gas chamber and the lamp is generally the exhaust tubulation 14 which is typically 1.7 mm. in inside diameter. This smaller diameter facilitates the final sealing of the lamp. During the dosing operation the rate of transport of the halogen and fill gas is effected by the narrowest constriction through which the vapor must pass. In the prior art where just halogen was vacuum transported from a source containing several hundred torr halogen partial pressure to a partially evacuated lamp with a residual pressure of several microns, the mean free path of the halogen atoms is such that the time required for the halogen to pass the constriction and equilibrate in the system is wasted time in the dosing operation. In practicing the method of the present invention the common source of halogen and fill gas allows for very quick transport of the fill gas and halogen, since the combined pressure is much higher than the partial pressure of the halogen alone. This results in a very quick dosing mechanism which makes high speed production of quartz-halogen lamps possible.

While iodine was used in the foregoing examples the other halogens (bromine, fluorine, and chlorine) can also be dosed using the present method with proper adjustments in the temperature of the halogen and fill gas chamber. Likewise, other inert fill gases can be substituted for the argon.

The method is not to be limited to the specific pressures, etc. set forth above since these were given by way of example. The method is readily applicable to the dosing of single-ended

lamps.

We claim:

1. In the manufacture of a halogen cycle incandescent lamp having a light-transmitting envelope which encloses a predetermined volume, the method of dosing said envelope with predetermined amounts of selected halogen and inert fill gas, which method comprises:

- a. connecting said envelope to an interconnecting chamber which has a predetermined volume and is connected by valved conduits to a vacuum system and to a common source of said halogen and fill gas;
- b. evacuating said envelope and said interconnecting chamber;
- c. transporting predetermined amounts of said halogen and said fill gas from said common source of halogen and fill gas into said evacuated interconnecting chamber and envelope, and then sealing off said interconnecting chamber from said common source of halogen and fill gas;
- d. cooling at least a portion of said envelope to a temperature sufficient to cause substantially all of the halogen and fill gas in said interconnecting chamber to flow into said envelope; and
- e. sealing off said envelope from said interconnecting chamber.

2. The method as specified in claim 1 wherein:

said envelope is connected to said interconnecting chamber via a valved conduit which is initially closed so that said halogen and fill gas are initially transported into said interconnecting chamber; and

after said envelope has been cooled, the said valved conduit connecting the envelope and interconnecting chamber is opened so that the halogen and fill gas in said interconnecting chamber flow into the cooled envelope.

3. The method as specified in claim 1, wherein said cooling temperature is below the condensation point of said fill gas.

4. The method as specified in claim 1, wherein said halogen is maintained at a temperature below the boiling point of said halogen.

5. The method as specified in claim 1 wherein said cooling temperature is such that the amount of fill gas transported into the cooled envelope provides greater than one atmosphere of fill gas partial pressure in said lamp at ambient temperature.

6. The method as specified in claim 1, wherein said halogen is iodine, and said iodine is condensed in said lamp in an amount of from 0.1 to 1.0 micromole per cc. of lamp volume.

7. The method as specified in claim 1, wherein said fill gas is argon and said argon is condensed in said lamp in an amount providing a partial pressure of about 2½ atmospheres at ambient temperature.

8. The method as specified in claim 1 wherein;

said common source of halogen and fill gas comprises a second chamber that contains a nonvaporized supply of said halogen and is connected by a valved conduit to a pressurized supply of said fill gas, and

said second chamber is heated to a temperature which provides a predetermined mixture of fill gas and vaporized halogen for subsequent transportation into the evacuated interconnecting chamber and lamp envelope.