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J. A. M. VAN LIEMPT  
ELECTRIC INCANDESCENT LAMP

1,925,857

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Fig. 1.

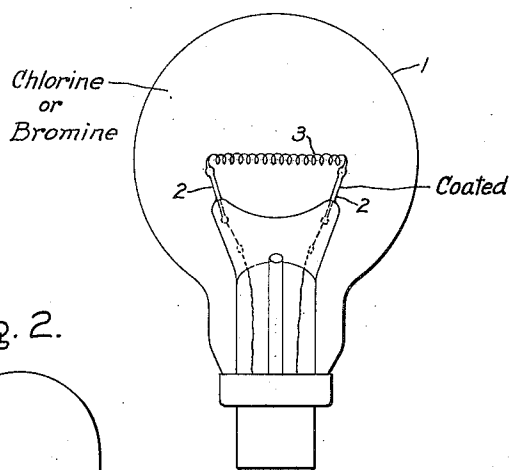
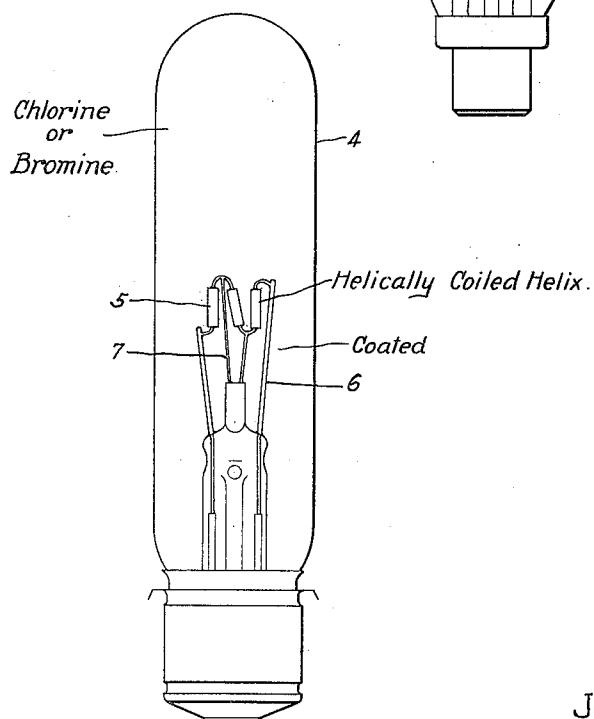


Fig. 2.



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## UNITED STATES PATENT OFFICE

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## ELECTRIC INCANDESCENT LAMP

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4 Claims. (Cl. 176—16)

My invention relates to electric lamps and more particularly to electric incandescent lamps and similar devices which comprise a filament composed of refractory metal such as tungsten or carbon. A gas filling for such lamps consisting of a material which reacts with the material of the filament according to a certain cyclic process has advantages over a filling of inert gas. A reaction takes place below certain temperatures between the gas filling and the material of the filament to form one or more compounds and at a higher temperature those compounds are dissociated and the material which had evaporated from the filament is returned. For example, if a tungsten wire is heated to 1000° C. in an atmosphere of chlorine, the compound  $WCl_6$  will be formed and it will subsequently be dissociated at the surface of the filament when it reaches a temperature over 1700° C., forming  $W+3Cl_2$ , the free tungsten being deposited on the said filament. According to my invention the parts of the filament, which glow at a temperature where the compound is formed but which do not reach a temperature high enough to cause the subsequent dissociation of the compound, are protected by a material against the action of the gas filling. This is accomplished by coating the filament entirely or partially with said material. Such material is preferably such that it is not effective at the higher temperatures since the gas filling does not have a detrimental action on the filament at said higher temperature on account of the redistribution or return of the filament material.

According to my invention, the gas filling may consist of a halogen such as chlorine, bromine or iodine or compounds or mixtures thereof, and these may or may not be mixed with inert gases such as are ordinarily used in gas-filled incandescent lamps of the type disclosed in Langmuir Patent No. 1,180,159. In selecting the material, the matters of breakdown voltage, heat conduction and velocity of reaction must be considered. The pressure of the gas-filling should be somewhere between the minimum at which the cycle is just fast enough to increase the life of the filament sufficiently and the maximum above which the pressure during the glowing of the filament becomes so high as to be dangerous. The bulb may be filled initially with the gas or a material may be placed in the bulb from which the heat of the filament will develop the haloid or compound.

The accompanying drawing shows incandescent lamps to which my invention is applicable, Fig. 1 illustrating a lamp having the leads and

adjacent portions of the filament coated with a protective layer, and Fig. 2 shows a lamp provided with a double helical filament coated entirely with a protective layer.

The filament material may be tungsten, carbon, rhenium, or other material of sufficiently refractory character, but tungsten is preferred, and the form of the filament is preferably helical or double helical. The critical temperature below which the cyclic process does not take place is about 1700° C. for tungsten. The protective material for the filament should supply this protection up to at least 1700° C. The filament may be covered entirely or partly with the protective material. In addition the metal parts which support the filament may be covered with protective material. The materials which may serve for protection may be an oxide of high melting point or a nitride, carbide, boride, silicide or mixture of these. For example,  $SiO_2$ ,  $Al_2O_3$ , beryllium nitride, titanium nitride, titanium carbide, calcium orthosilicate ( $Ca_2SiO_4$ ) and sillimanite ( $Al_2SiO_5$ ) may be used. The material must be chosen with regard to its coefficient of expansion and that of the filament material. Different layers of materials may be used. Straight or spiral filaments may be utilized. It is not necessary that the protective material be coated on the filament as the filament may, for instance, be partly sealed in a protective tube.

As a specific example, a tungsten coiled filament as shown in Fig. 1 may be located in a bulb 1 which is filled with chlorine at a pressure of 1 mm. mercury. The leads 2 and portions of the filament 3 adjacent thereto are covered with a protective layer of one of the materials hereinbefore referred to. Another specific example, as also indicated in Fig. 1 is a lamp comprising a coiled filament located in a bulb filled with bromine of 10 mm. pressure. Those parts of the filament and of the leads which glow below the critical temperature are covered with a protective layer. Another specific example, as illustrated by Fig. 2 is a bulb 4 filled with chlorine or bromine and containing a double helical filament 5. The entire filament and leads 6 are covered with the protective layer. When the lamp is turned on, the protective layer will be evaporated from those portions which reach a sufficiently high temperature. Where support wires 7 are used, these may be also coated with protective material.

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

1. An electric incandescent lamp comprising a filament, leads connected to said filament, a bulb

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|    | having a gas filling comprising a haloid, said filament being of material which reacts with the gas-filling according to a cyclic process, and a protective material covering hermetically at least such                                                                                                                                                                                                                                                                                                          |     |
| 5  | parts of said filament as are adjacent to said leads and do not reach a comparatively high temperature and would be otherwise injuriously affected by said gas filling.                                                                                                                                                                                                                                                                                                                                           |     |
| 10 | 2. An electric incandescent lamp comprising a filament, leads connected to said filament, a bulb having a gas filling comprising a haloid mixed with an inert gas, said filament being of material which reacts with the gas-filling according to a cyclic process, and a protective material covering hermetically at least such parts of said filament as are adjacent to said leads and do not reach a comparatively high temperature and would be otherwise injuriously affected by said gas filling.         |     |
| 15 | 3. An electric incandescent lamp comprising a tungsten filament, leads connected to said filament, a bulb having a gas filling comprising a haloid, said filament being of material which reacts with the gas-filling according to a cyclic process, and a protective material covering hermetically at least such parts of said filament as are adjacent to said leads and do not reach a comparatively high temperature and would be otherwise injuriously affected by said gas filling.                        | 80  |
| 20 | 4. An electric incandescent lamp comprising a filament, leads connected to said filament, a bulb having a gas filling comprising a haloid, said filament being of material which reacts with the gas filling according to a cyclic process, and a protective material consisting of an oxide of high melting point covering at least such parts of said filament as are adjacent to said leads and do not reach a comparatively high temperature and would be otherwise injuriously affected by said gas filling. | 85  |
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