UNITED STATES PATENT OFFICE.

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INCANDESCENT TUNGSTEN LAMP.

1,240,700. Specification of Letters Patent. Patented Sept. 18, 1917.

No Drawing. Application filed June 11, 1913. Serial No. 773,007.

To all whom it may concern:

Be it known that I, ERNST FRIEDERICH, a subject of the Emperor of Germany, residing at Berlin, Germany, have invented certain new and useful Improvements in Incandescent Tungsten Lamps, of which the following is a specification.

It is now common practice to place in the interior of incandescent tungsten lamps chlorin-evolving substances to prevent or reduce the blackening of the wall of the bulb which otherwise occurs during the burning of the lamp. Such lamps can burn with very favorable economy, for example, .8 watts per candlepower, but they have the disadvantage that gaseous chlorin combinations are formed in them, partly from the substance itself that is introduced into the lamp, and partly by reaction with the tungsten of the incandescent body. These gaseous chlorin combinations continually increase the gas pressure in the lamp until after a certain amount of burning a point is reached where the current no longer passes exclusively through the filament but also passes through the space filled with gas. These discharges through the gas result in the rapid destruction of the lamp. This difficulty appears particularly in high voltage lamps, as for example, those of 220 volts.

The object of the invention is to provide an incandescent tungsten lamp in which blackening of the bulb wall is prevented by means of a gaseous atmosphere and good economy is possible, but in which nevertheless the above mentioned destructive phenomena are avoided. In accordance with the invention the tungsten incandescent body burns in an atmosphere which contains oxygen of low pressure. The action of this atmosphere is apparently due to the fact that oxygen of low pressure, strange to say, does not noticeably attack the white hot tungsten filament or wire, but in the colder zones of the lamp oxidizes the vaporized tungsten to tungsten trioxid. This oxid is not volatile and is deposited on the glass bulb and other parts of the lamp, but the deposit can be called practically colorless compared with the deposit of tungsten metal. Indeed, the non-volatility of the reaction product that is formed is of substantial importance for the invention, for no gaseous compounds of any sort are formed in the lamp by the method of the present invention, so that the pressure in the lamp cannot be increased by such compounds and gas discharges are prevented. The definite effect of the oxygen occurs at pressures so low that they cannot be measured by the ordinary methods. The behavior on vacuum test by the induction coil or similar apparatus commonly used in the lamp factories is the same as in those lamps which are regarded as well exhausted, or as having what is commonly designated in the lamp factories as a first class vacuum and therefore the oxygen pressure is always less than five one-thousandths of a millimeter of mercury and usually less than one one-thousandth of a millimeter.

It may be noted that a filling of oxygen has already been employed in osmium lamps. The effect of this filling depended upon the ready volatility of osmium tetraoxid, which is the product of the reaction arising from the coöperation of the filament material and the gaseous atmosphere, and from which osmium is again precipitated on the white hot filament. This method presupposes high gas pressure, and consequently is not applicable with high voltage lamps, since then the gas discharges immediately appear. In distinction from this, the present invention, which relates to tungsten incandescent lamps, has as characteristic features the non-volatility of the product of reaction and a low gas pressure not exceeding that of a first-class vacuum for the purpose of avoiding gas discharges. The effect described cannot be attained by filling the lamps with a small amount of gaseous oxygen nor by imperfectly exhausting them, which seems still more simple. Under such circumstances, of course, the oxygen would very quickly disappear during the burning of the lamp and the favorable effect upon the length of life of the lamp would not be obtained. In order to secure the desired effect precautions must be taken in order that the oxygen that is consumed may be renewed constantly or at least during quite a large part of the useful life of the lamp. This result is secured by introducing into the interior of the lamp substances which at the temperature and under the conditions which prevail in the lamp have a certain small oxygen pressure due to dissociation or decomposition and consequently give up continuously as much oxygen as is consumed

by the oxidation of the vaporized tungsten. Some of the suitable substances are oxids, peroxids, nitrates, nitrites, chlorates, perchlorates, chromates, bichromates, and others. In particular, manganese superoxid is very satisfactory and barium chlorate especially so. It may be noted that some of these substances may be decomposed more or less in the lamp during burning or perhaps during the exhaustion of the bulb which usually takes place at a somewhat high temperature. For example, the barium chlorate may be decomposed into barium chlorid and barium perchlorate, in which case perhaps the latter would be the effective substance, or potassium permanganate can be decomposed into potassium manganate and manganese superoxid.

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

1. An incandescent lamp comprising a sealed envelop, a tungsten filament therein, and a solid oxygen containing compound in the envelop in such a position that the incandescent filament causes said solid compound to evolve in said envelop at a pressure no greater than substantially the pressure of a first-class vacuum an oxygen containing atmosphere which reacts with the vaporized tungsten to form solid and substantially transparent nonvolatile reaction products which do not increase the pressure of the atmosphere in the envelop.

2. An incandescent lamp comprising a sealed envelop, a tungsten filament therein and a solid inorganic compound containing oxygen and positioned in the envelop to be heated by the filament, said compound having at the temperature attained by it during operation of the lamp an oxygen dissociation pressure not greater than substantially the pressure of a first-class vacuum and maintaining during the life of the lamp an oxygen atmosphere at said pressure to react with the vaporized tungsten and form solid substantially transparent and nonvolatile reaction products which do not increase the pressure in the envelop.

3. An incandescent lamp comprising a sealed bulb, a tungsten filament therein, and a solid inorganic compound containing oxygen and decomposable with evolution of oxygen when heated in the lamp by the filament and positioned in the lamp to attain a temperature at which oxygen is evolved at a pressure not greater than that of a first-class vacuum, and is maintained during the life of the lamp to produce with the vaporized tungsten solid substantially transparent and nonvolatile reaction products.

4. An incandescent lamp comprising a bulb, a tungsten filament therein, and barium chlorate positioned in said bulb to attain a temperature at which said barium chlorate evolves an oxidizing atmosphere at a pressure not greater than substantially the pressure of a first-class vacuum.

In witness whereof, I have hereunto set my hand this 9th day of June, 1913.

ERNST FRIEDERICH.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.