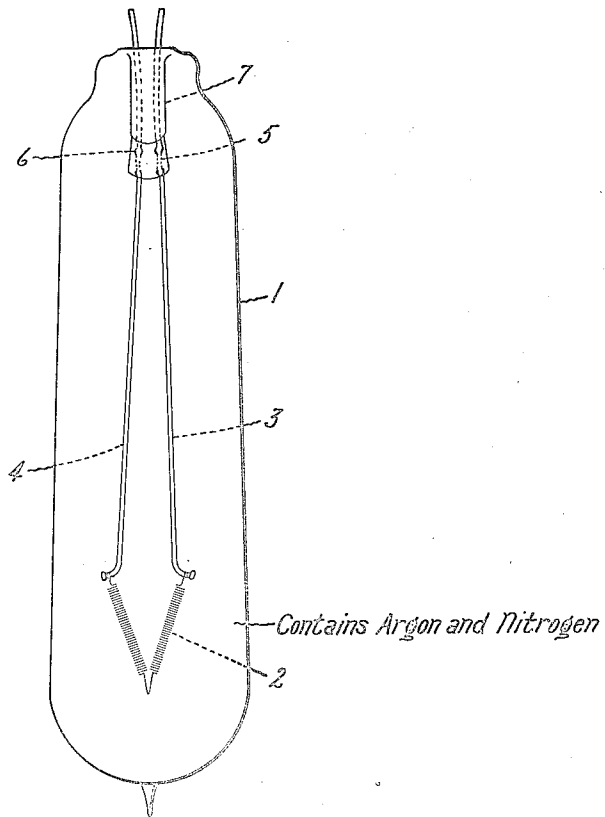


R. JACOBY.
INCANDESCENT LAMP.
APPLICATION FILED JUNE 27, 1914.

1,154,514.

Patented Sept. 21, 1915.



WITNESSES:

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UNITED STATES PATENT OFFICE.

RICHARD JACOBY, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY,
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INCANDESCENT LAMP.

1,154,514.

Specification of Letters Patent.

Patented Sept. 21, 1915.

Application filed June 27, 1914. Serial No. 847,715.

To all whom it may concern:

Be it known that I, RICHARD JACOBY, a subject of the King of Prussia, residing at Berlin, Germany, have invented certain new and useful Improvements in Incandescent Lamps, of which the following is a specification.

The present invention relates to incandescent lamps and particularly to lamps in which a metal filament is operated in an envelop containing a gas.

It is the function of the gas to reduce the vaporization of the filament and thus to enable it to be operated at a higher temperature. The low heat conductivity of the heavier rare gases of the atmosphere, for example, argon renders their use in gas-filled lamps advantageous. It has been found, however, that in lamps filled with rare gases the film of material deposited on the bulb is more opaque than in nitrogen-filled lamps. Lamps filled with these rare gases also are subject to arcing at a lower temperature than lamps filled with nitrogen. In accordance with the present invention these drawbacks are overcome without substantial sacrifice of the low heat losses of the rare gases by adding a small amount of nitrogen.

The accompanying drawing shows somewhat diagrammatically, an incandescent lamp illustrating one form commonly employed when a gas filler is provided.

This lamp comprises an elongated envelop 1, in which is mounted a coiled filament 2 which commonly consists of tungsten, although other refractory metals also may be used. The diameter of the glower should be so chosen that it may be operated at excessively high temperatures for a good commercial life of the lamp. The increased diameter decreases the proportionate convection and conduction losses so that the filament may emit light at an efficiency higher than it would have in a vacuum if operated so as to have the same useful life. Coiling the filament in a close spiral gives the effect of an increased diameter. The filament is attached either by welding or mechanically to supporting wires 3 and 4, which project into the globe to locate the filament near the lower end. Electrical energy is supplied by leading-in conductors

5 and 6 sealed into a stem 7 in the usual well understood manner.

The lamp is filled with a mixture of a rare gas or gases and nitrogen having a pressure measured when the lamp is cold, of about 400 mm. of mercury or as low as about 100 mm., but while the higher range of pressures is preferable the pressure should not be so high as to endanger the bulb when the filament is heated. It is the function of this gaseous atmosphere to reduce the tendency of the filament to vaporize and also to carry away by convection currents the small amount of vapor which is inevitably produced. The gas can suppress but not entirely prevent vaporization of the filament.

Although the lamp is so constructed that the vaporized material is deposited near the upper end of the globe where it will not obstruct the light, in time some of the material may be deposited near enough to the filament to cut off the light. When using the rare gases of the atmosphere, for example, argon, and krypton which are extremely inert chemically and for this reason are known also as the "noble gases," the film of vaporized metal is black and opaque as the deposited metal remains chemically uncombined.

Experiments have shown that when only a very small amount of nitrogen is added to the argon or other rare gas filling that the deposit on the walls of the globe assumes a lighter color and obscures less light. This light colored deposit has been found in the tungsten lamp to be a nitride of tungsten. This action takes place even when the amount of nitrogen is very small, for example, one-tenth of one per cent. A small amount of nitrogen does not materially reduce the heat conductivity, as this is proportional to the relative amounts of argon and nitrogen present. Of course, in some cases greater amounts of nitrogen may be used, say up to 10% or even more, the heat conductivity being correspondingly higher. The presence of nitrogen also has been found to reduce the arcing to a surprising extent, the discharge voltage increasing rapidly with even a small nitrogen content instead of being proportional to the nitrogen content as might be expected. Even a small percentage of nitrogen raises the discharge

voltage to the value characteristic of pure nitrogen.

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

- 5 1. The combination of an envelop, a glower of refractory metal mounted therein, means for supplying energy thereto, and a mixture of argon and nitrogen surrounding said glower.
- 10 2. The combination of an envelop, a tungsten filament mounted therein, means for supplying energy thereto, and gaseous mixture consisting largely of argon and a small amount of nitrogen surrounding said
15 filament.
3. An incandescent lamp, comprising a globe, a tungsten filament located therein, current conductors for said filament, and a

gas filling at relatively considerable pressure for said globe, comprising nitrogen and 20 argon.

4. An incandescent lamp comprising a transparent envelop, a gaseous filling comprising argon and about 0.1% to 10% of nitrogen in said envelop, and a tungsten 25 glower therein proportioned in size to operate at an efficiency higher than the efficiency said glower would have in a vacuum if operated so as to have the same useful life.

In witness whereof, I have hereunto set 30 my hand this 11th day of June, 1914.

RICHARD JACOBY.

Witnesses:

D. KARL NEY,
ERNST FRIEDERICH.