

I. LANGMUIR.
INCANDESCENT LAMP.

APPLICATION FILED DEC. 20, 1913. RENEWED MAR. 25, 1916.

1,188,186.

Patented June 20, 1916.

Fig. 1.

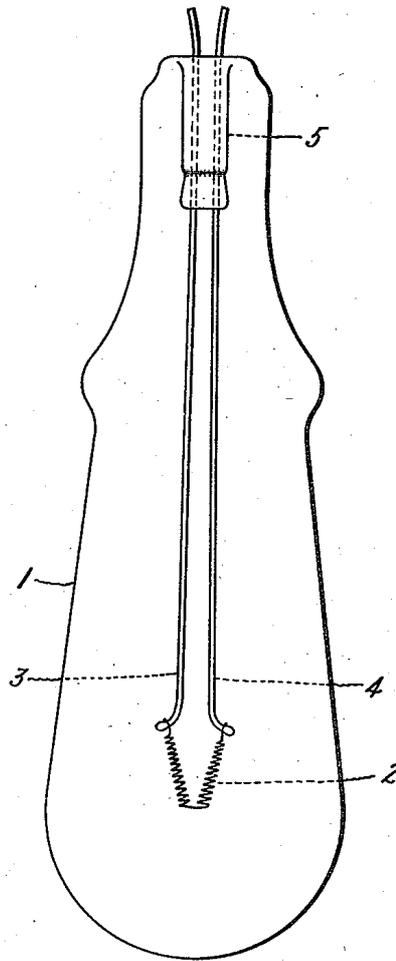
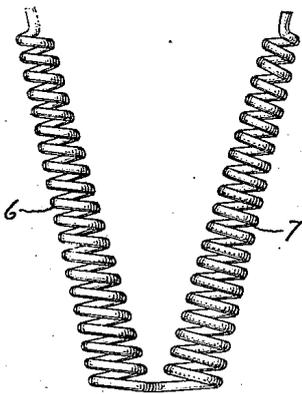


Fig. 2.



Witnesses:

George W. Tilden
J. Ellis Glen

Inventor:

Irving Langmuir.
by *Albert H. Davis*
His Attorney.

UNITED STATES PATENT OFFICE.

IRVING LANGMUIR, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

INCANDESCENT LAMP.

1,188,186.

Specification of Letters Patent. Patented June 20, 1916.

Application filed December 20, 1913, Serial No. 807,827. Renewed March 25, 1916. Serial No. 86,798.

To all whom it may concern:

Be it known that I, IRVING LANGMUIR, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Incandescent Lamps, of which the following is a specification.

The present invention relates to the structure or shape of filaments for incandescent lamps, and particularly to lamps in which a helical filament is operated at intensive incandescence in an atmosphere of inert gas.

In some types of lamps, for example, when the globe is filled with inert gas, it is desirable to wind, or coil the filament into compact form, such as a helix.

It is the object of my present invention to secure uniformity of temperature of the filament and to prevent or reduce distortion of a filament thus coiled when pliable at a high temperature.

In accordance with my invention the filament temperature is made substantially uniform by making the upper turns or coils smaller in diameter than the lower turns.

My invention will be more clearly understood by reference to the following description taken in connection with the accompanying drawing in which—

Figure 1 shows a lamp of the gas-filled type in outline, and Fig. 2 is an enlarged detail view of the filament.

The envelop 1 is elongated so as to constitute the upper part of the envelop a condensing chamber in which vaporized filament material may be deposited without obstructing the light from the filament, but this particular structure of the envelop forms no part of my present invention.

The filament 2 consists of drawn tungsten or other highly refractory material and is joined by welding or in any other suitable manner to lead wires 3 and 4 sealed as usual into the stem 5 of the lamp. When the lamp is of the gas-filled type in which the filament is operated at intensive incandescence, the globe 1 is provided with a filling of nitrogen, argon or other inert gas at a pressure varying from about 50 m. m. of mercury to about one-half atmosphere as described in my patent No. 1,180,159.

The filament may be shaped by coiling

one-half upon a mandrel of varying diameter so as to taper the resulting helix, then slipping one-half from the helix and coiling the remainder. In Fig. 2 the distance between the adjacent turns of the helix has been somewhat exaggerated. Ordinarily, the spaces between the turns are less than the diameter of the wire constituting the helix. The filament is shown supported in such a manner that it constitutes two sections 6, 7. While a filament need not assume this precise shape, it serves to illustrate one principle of my invention, namely, to secure the greatest compactness of the filament so as to reduce heat losses by convection to a minimum while avoiding a distortion of the filament. When the filament is at incandescence and hence soft, the upper turns would tend to operate at a somewhat higher temperature due to the increased heating caused by the heat from the lower part of the filament being carried upward by the gas convection currents. When as shown particularly in Fig. 2 the turns progressively decrease in diameter passing from the lower to the upper end of the filament the heat dissipating capacity is made greater as the diameter decreases. In this manner the temperature of the turns of the helix is made substantially uniform, or, indeed, the taper may be great enough to cause the upper turns to operate relatively cooler than the lower turns so as to enable the upper turns by reason of their greater stiffness to support the weight of the rest of the filament without spreading.

The cooling effect of the leads would make unnecessary a reduction of diameter of the turns immediately adjacent the supports, but for the sake of simplicity and convenience the taper of the helix has been shown as being uniform. In fact, the cooling effect of the leads may be advantageously reduced by decreasing the cross-section of the filament ends at the point of connection to the leads.

My invention is of course applicable to a filament departing from the shape of a helix in which the general principle is observed of securing maximum strength with or without increased cooling effect at the turns upon which the weight of the filament is imposed,

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

1. An incandescent lamp comprising an envelop, a filling of inert gas and a helical filament mounted in said envelop, the upper part of said filament shaped to dissipate heat at a greater rate by convection than the lower part of said filament.
2. In an incandescent lamp current-supply wires, a filament connected thereto which is pliable at incandescence, said filament having a helical form, the turns of the helix increasing in diameter substantially in the order of their distance from the supply wires, and an inert atmosphere surrounding said filament.
3. In an incandescent lamp, a helical filament which at its operating temperature is in a relatively pliable state, supports therefor, the turns of said filament varying in extensibility substantially in the order of their distance from the points of support.
4. The combination of an envelop, an inert gas in said envelop, a filament therein

coiled into helical form, supports therefor, the turns of the helix being smaller in diameter near said supports than at a region farther removed therefrom.

5. An incandescent lamp filament comprising vertical helices of tungsten, supporting conductors connected to the terminals of said helices, the turns of said helices near said connection being smaller in diameter than turns farther removed from said connection.

6. The combination of an envelop, an inert gas therein, a support and a metal filament pliable at incandescence connected thereto, said filament comprising a plurality of turns increasing in diameter as the weight supported thereby decreases.

In witness whereof, I have hereunto set my hand this 18th day of December, 1913.

IRVING LANGMUIR.

Witnesses:

BENJAMIN B. HULL,
WILLIAM C. WHITE.