

I. LANGMUIR.  
INCANDESCENT LAMP.  
APPLICATION FILED MAR. 13, 1917.

Patented July 2, 1918.

1,271,483.

Fig. 1.

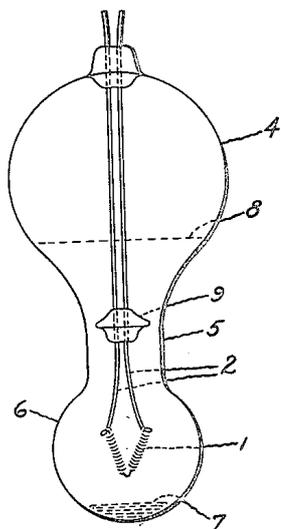
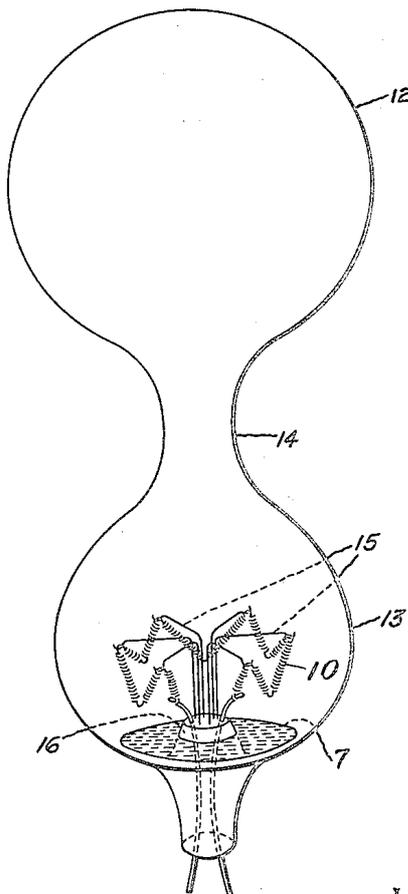


Fig. 2.



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# UNITED STATES PATENT OFFICE.

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## INCANDESCENT LAMP.

1,271,483.

Specification of Letters Patent.

Patented July 2, 1918.

Original application filed September 4, 1913, Serial No. 788,165. Patent No. 1,248,118, dated November 13, 1917. Divided and this application filed March 13, 1917. Serial No. 154,606.

*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, (division of my application filed September 4, 1913, Serial No. 788,165, patented November 13, 1917, No. 1,246,118,) of which the following is a specification.

My invention relates to incandescent electric lamps of the type disclosed in my prior Patents No. 1,180,159, issued April 18, 1916 and No. 1,246,118, issued November 13, 1917, and which are now known as gas filled lamps. In these lamps a filament of refractory material, such as tungsten operates in an atmosphere of inert gas of poor heat conductivity such as nitrogen or mercury vapor, and is so fashioned as to shape and size that it can be run at a much higher temperature and at a higher efficiency than would otherwise be possible. The present application concerns certain structural improvements in a gas filled lamp having a coiled filament, the helical winding of the filament being interrupted at certain points intermediate its ends so as to leave certain intermediate portions of the filament substantially uncoiled, particularly those portions where the filament is in contact with a filament support.

For a better understanding of my invention reference may be had to the accompanying drawings in which for purposes of illustration I have shown two of the forms in which my invention may be embodied. Figure 1 is a view of one form of lamp in which the coiled filament is supported entirely from its ends and has an intermediate uncoiled portion, and Fig. 2 is a view of a modified form in which the coiled filament is carried on supports which engage it at uncoiled portions intermediate its ends.

In the particular form of lamp shown in Fig. 1, a filament 1, preferably of drawn tungsten, is connected to and carried by comparatively stiff heavy leads 2, preferably made of tungsten or other highly refractory metal. The filament is so fashioned, as by coiling into a close helix, as to give the same effect with respect to exposed surface as though it were of relatively large cross sec-

tion, such as 10 or 20 mils in diameter. The high temperature which the filament can sustain without prohibitive vaporization under the conditions of operation enables a higher net efficiency to be obtained than is possible if the same filament were operated in a vacuum.

The leads 2 are hermetically sealed, as indicated conventionally in the drawings, into the walls of the lamp bulb, usually made of material such as glass or quartz. Any suitable seal may be employed, the particular seal to be used forming no part of my present invention. In the particular form of bulb shown the leads 2 are sealed into the wall of an upper portion or condensing chamber 4 which is connected through a constricted passage or neck 5 with the lower or bulb portion 6. This lower portion 6 is immediately adjacent the filament 1 and constitutes the light transmitting portion of the bulb. A quantity of material such as mercury 7 is placed in the bulb portion 6 close enough to the filament 1 to be vaporized by heat from the filament. The bulb portion 6 is of such a size and so proportioned that when the lamp is in operation its walls are kept at such a temperature by the heat from the filament that the mercury or other material will not condense on these walls, consequently the mercury vapor passes through the constricted neck 5 into the upper or condensing chamber 4 and is there condensed. When the lamp is in operation the mercury vapor may normally extend to about the level of the dotted line 8, the cooling and condensing action of the walls of the chamber 4 being sufficient to condense practically all of the mercury vapor before it rises any higher.

In some cases it may be desirable to place a baffle or similar device 9 adjacent the constricted portion or neck 5 in order to control the flow of mercury vapor from the lower bulb or chamber into the upper condensing chamber, whereby it sweeps up into the upper chamber as a sort of blast and carries with it any water vapor or foreign gas that may be liberated in the lower bulb. This baffle may assume many different forms, one simple form being that shown in the drawing in which a disk or plate of glass is se-

cured to the leads 2 in such relation to the neck 5 as to produce the desired effect on the flow of mercury vapor.

To avoid injury to the lamp between the turning on of the current and the evolution of mercury vapor I put into the lamp some suitable inert gas, such as nitrogen, which will absorb enough heat to prevent the filament attaining a dangerously high temperature before the mercury vaporizes, but the mercury vapor when produced displaces this inert gas so that, except momentarily at starting, the filament operates at a very high temperature in an atmosphere of the vapor of mercury at about atmospheric pressure. So far as concerns my present invention I regard the operation of the filament in an atmosphere of mercury vapor as equivalent to operating the filament in a different gaseous filling such as nitrogen.

Fig. 2 shows another form of lamp having a bulb substantially like an hour glass and with the leads entering through the bottom of the bulb 13 instead of through the top. The filament 10 of drawn tungsten is mounted in the bulb 13 in a suitable way, as for example, on supports 15 made of tungsten or other refractory wire and secured to a central stem 16. The filament in this figure, as in the other figure of the drawings, is shown as finely coiled into a helix of small diameter and with the spires close together, as already pointed out. It is to be observed, however, that wherever the filament is sharply bent or is passed over supports, such as 15, it is not coiled. The mercury 7 surrounds the stem and is so related to the fila-

ment that it vaporizes when the lamp is turned on and the filament becomes incandescent.

During operation of the lamp the uncoiled portions of the filament are strongly cooled by the convection action of the gas or vapor and the coiled portions adjacent an uncoiled portion are not overheated as might be the case if uncoiled sections were not employed. If without the use of uncoiled sections the helical filament were to be sharply bent where passed over a support, portions of the helix would thus be brought closer together, and, being thus less cooled by the gas, would become overheated, and thus subject to excessive disintegration.

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

1. An incandescent lamp comprising a sealed bulb having a gaseous filling of poor heat conductivity and a closely coiled tungsten filament supported in said bulb and having an uncoiled portion located between coiled portions, the said filament being sharply bent in the region of said uncoiled portion.

2. The combination of a sealed bulb containing a gaseous filling of poor heat conductivity, a filament support in said bulb and a closely coiled tungsten filament having an uncoiled portion located between coiled portions and in contact with said support, the said filament being sharply bent in the region of said uncoiled portion.

In witness whereof, I have hereunto set my hand this 12th day of March, 1917.

IRVING LANGMUIR.