

Feb. 20, 1940.

K. L. WADE
INCANDESCENT LAMP
Filed Oct. 12, 1937

2,191,189

3 Sheets-Sheet 1

Fig. 1.

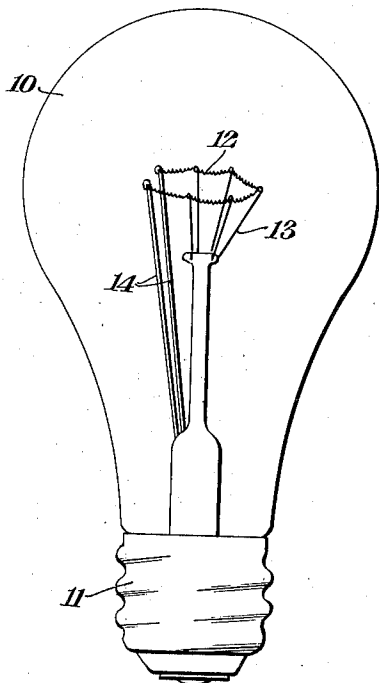


Fig. 2.

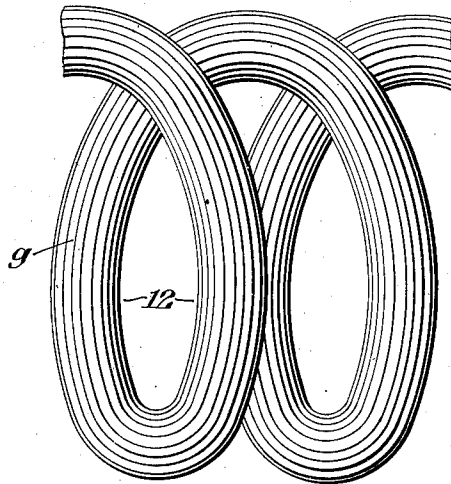


Fig. 3.

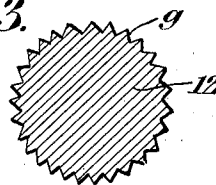


Fig. 4.

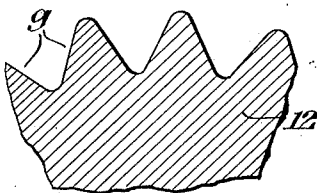


Fig. 5.

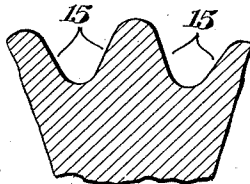


Fig. 6.

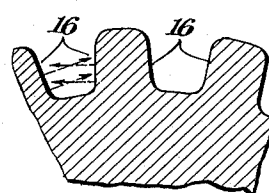
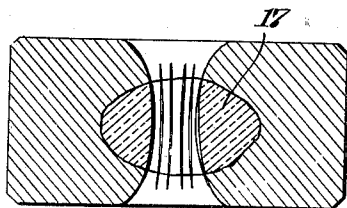


Fig. 7.



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3 Sheets-Sheet 2

Fig. 8.

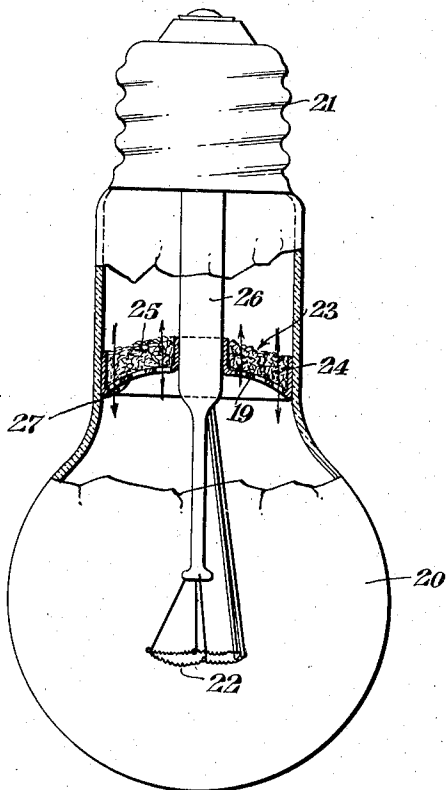


Fig. 10.

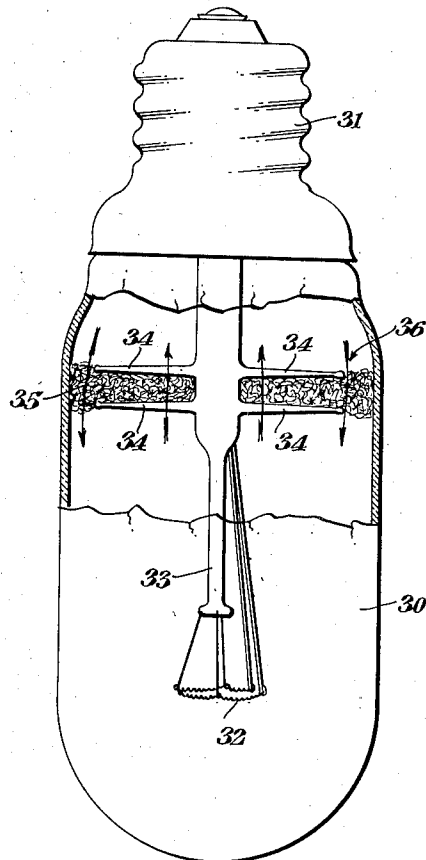


Fig. 9.

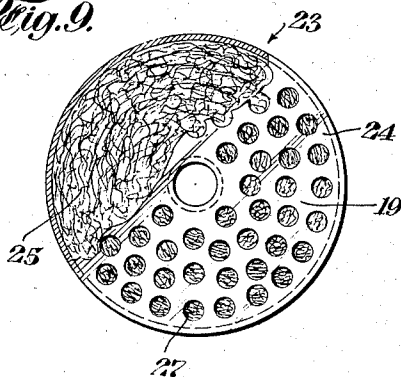
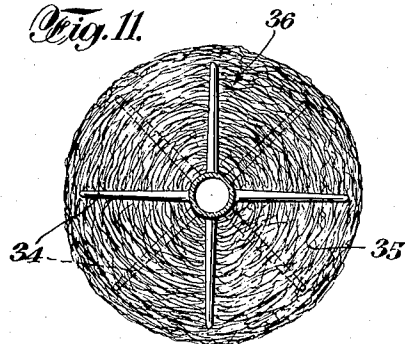


Fig. 11.



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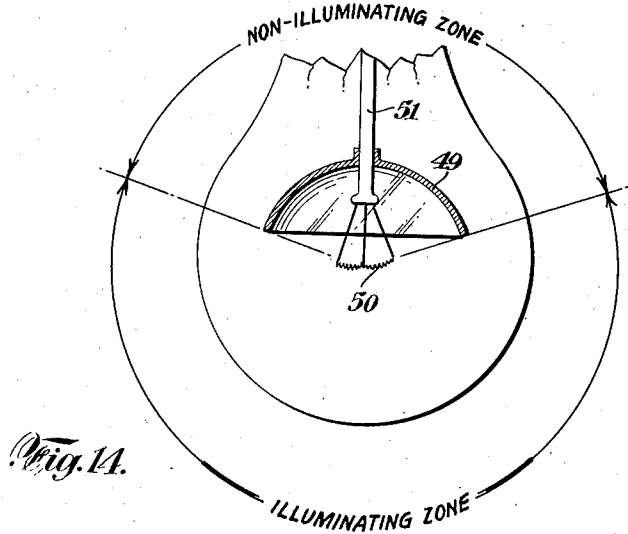
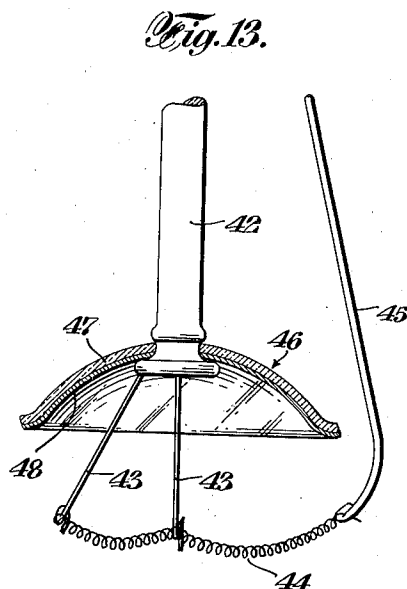
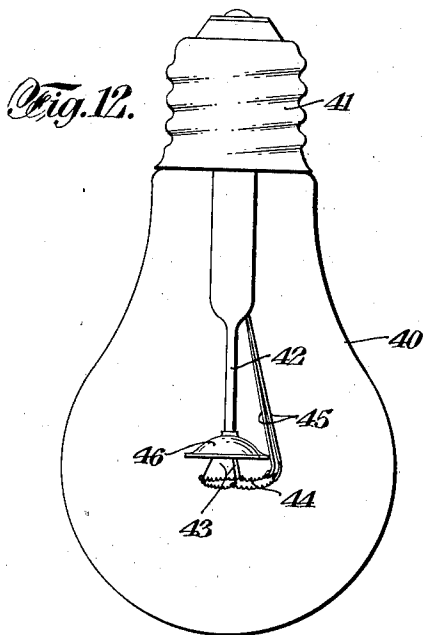
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INCANDESCENT LAMP

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,191,189

INCANDESCENT LAMP

Kenneth L. Wade, New York, N. Y.

Application October 12, 1937, Serial No. 168,531

7 Claims. (Cl. 176—40)

This invention primarily relates to improvements in an incandescent lamp and more particularly to improvements designed to make such a lamp more efficient and economical. The principal features of the improvements are embodied in the filament and in provisions for reflecting light rays and cleaning the gas currents inside an incandescent lamp of the vaporized particles of the filament which would otherwise soil the lamp globe.

Specifically this invention contemplates the fabrication and use of a filament having a grooved surface to reduce the losses from filament evaporation and to increase the efficiency of such a filament as much as possible by the use of grooves. Another contemplated improvement is the provision of a filter means to take out of the gas currents inside of a lamp the evaporated particles of the filament which are carried away by such currents and may be deposited on and stain the globe. Still another feature is a reflector so placed as to redirect those light rays from the filament which are originally headed towards the non-illuminating areas of the lamp. The desirability of these improvements immediately becomes apparent to those familiar with the problems of the art.

Present day incandescent lamps are usually provided with a round tungsten wire filament. It has long been known that tungsten particles vaporized from the filament, causing a proportionate decrease in the size of the filament and normally also in the efficiency and life of the lamp. Further it was known that this action, while somewhat retarded by the surrounding gas in a gas-filled lamp, still took place in sufficient measure to be the source of a "brown deposit" which adhered to the inside surface of the lamp globe. This deposit carried by convection currents inside such globe was chiefly objectionable from a light reducing viewpoint. The use of a grooved filament to retard such particle vaporization or of a filter to catch what particles do leave the filament body or of a curved reflector to redirect rays that otherwise would fall on non-illuminating areas inside the lamp is unknown in prior lamps, so far as the inventor now knows. The use of a grooved filament in lamps such as radio and X-ray tubes where electron emission filaments perform with its concomitant advantages hereinafter set forth, also is as yet unknown to the tube industry.

In a preferred embodiment, the new filament is grooved lengthwise at spaced intervals around its periphery. In cross section such a filament

resembles a toothed gear in side elevation and by means of these grooves the normal evaporation loss of the filament is materially lessened. It may be that the sides of each groove produce this great advantage by blocking and retaining the particles vaporized from the opposing sides of the respective grooves, but the result achieved is a lamp filament having greater efficiency and a longer life than the corresponding standard filament in use today. Similar benefits are obtained by using a filament of this type in any application of an incandescent filament, such as in the electron emission filaments of radio and X-ray tubes, where present day performance would be materially advanced by a reduction in evaporation loss of the filament.

In a similar fashion the grooves on the surface of the filament will produce areas of heat concentration where the heat rays are intercepted by the sides thereof. The inventor believes that such concentration will produce from a tungsten filament of this invention more light rays in the visible spectrum than a corresponding standard tungsten filament.

Most lamps are gas-filled and the heating of such gas in proximity to the filament produces convection currents carrying away some portion of whatever particles are vaporized from the filament. These particles oftentimes deposit on the globe in the illumination areas in the form of a "brown deposit" (for tungsten filaments) so that the positioning of a filter in the path of such currents to cut down the "brown deposit" is of considerable benefit. True, the deposit would be made on the filter instead, which in one of the described forms is made of glass wool, but since such a filter is placed in a position outside of the illumination zone, its effect would be very marked in keeping the currents and consequently the globe clean. As for the light rays which head towards the non-illuminating zone of the lamp, part of this invention is a mirror-like device which bends such rays around and into the proper directions. Usually this device will be in the form of a small concave reflector placed adjacent the filament in the non-illumination region.

It is an object of this invention to produce a filament to be heated to incandescence suitable for use in an incandescent lamp, and X-ray or radio tube, characterized by a series of grooves in its periphery.

It is an object of this invention to produce a longer lasting and more efficient incandescent lamp by the fabrication and use therein of a fila-

ment grooved substantially in a lengthwise direction.

It is another object of this invention to retard the normal deposit of vaporized particles of a filament on the inside of the globe of such a lamp by the interposition of a filter in the path of flow of such particles.

It is still another object of this invention to reflect light rays which ordinarily fall in the non-illuminating zone of an incandescent lamp into the illuminating zone thereof.

It is a further object to design a filament according to this invention which, or the preferred embodiment at least of which, may be die-drawn in similar manner to the present day drawing of such filaments.

Other objects, advantages and features will be had from a study of the balance of this specification and the accompanying drawings; in which:

Fig. 1 is a view in elevation of an incandescent lamp utilizing the filament of this invention;

Fig. 2 is an enlarged view of two loops of a filament coil embodying a preferred form of this invention;

Fig. 3 is an enlarged view in cross-section of the filament of Fig. 2;

Figs. 4 to 6 inclusive, are fragmentary cross-sectional views of different contours which the grooves in the filament of this invention may have;

Fig. 7 is a cross-section view of a die for one form of the filament of this invention;

Fig. 8 is a plan view of an incandescent lamp, partly in cross-section, showing one form of the filter of this invention for cleansing the convection currents of "brown deposit";

Fig. 9 is a plan view of the filter assembled in Fig. 8;

Fig. 10 is similar to Fig. 8, but showing a modified form of such a filter;

Fig. 11 is a plan view of the filter assembled in Fig. 10;

Fig. 12 is an incandescent lamp showing one form of the reflector of this invention for redirecting light rays;

Fig. 13 is an enlarged view of the reflector of Fig. 12 and adjacent parts; and

Fig. 14 is a modified form of such a reflector mounted in a lamp.

Referring to the drawings, 10 and 11 respectively are the globe and base of an incandescent lamp. However, this lamp contains the filament 12 which is a feature of this invention, mounted upon the usual supports 13 and connected to the base by the usual leads 14. Filament 12 preferably is coiled and is grooved (Fig. 2) lengthwise at spaced intervals so that in cross-section it appears as shown in Fig. 3. For better depiction the scale for the filament details is oversize. When filament 12 is heated to incandescence the normal evaporation loss of particles of filament material, generally tungsten, is arrested to a great degree by coming in contact with the side of the groove opposite to the side or surface of particle origin whereupon the particle adheres to such opposite side and the normal loss by vaporization which reduces the filament is materially lessened. The probable explanation is that such vaporization takes place normally to the surface and with the grooved filament practically all of the filament surface is composed of the sides of the grooves, particles from one surface will be blocked by the other surface of each groove where they will adhere and vice versa.

Light and heat rays emanate from the filament surfaces perpendicular thereto—similar to the explanation offered regarding the path of vaporized particles—and in like fashion impinge on the opposite wall whence the bombardment raises the surface temperature in the grooves. Such heat concentration reduces cooling losses and also quite possibly contributes to the increase in the efficiency of a lamp with the filament of this invention by contributing to a rise in the temperature of the filament and hence to an increase in the light emission therefrom. The sum total of the advantages of using such a filament results in a lamp having a greater efficiency through a rated life or a longer life or both.

Illustrated in Figs. 5 and 6 are differently shaped grooves, 15 and 16, which may be employed without departing from the scope of the invention. In fact, while the preferred embodiment of filament 12 is grooved parallelwise to its longitudinal axis, such grooving can be in the form of a broken or continuous helix and will produce the advantages of this invention in the way of particle blocking and increased efficiency. Nor is the use of such a filament restricted to incandescent lamps since it may also be used with profit in radio and X-ray tubes where electron emission by the filament is the filament's prime function.

Fig. 7 is cross-section view of a tungsten wire drawing die such as would be used to produce filament 12 by the application of known drawing methods. It consists of a body and an insert 17 made of tungsten carbide or diamond and its use will result in an economically produced tungsten filament similar to filament 12.

In the incandescent lamp disclosed in Fig. 8, 20 is the globe and 21 is the base thereof. Inside the lamp are filament 22 with the usual appurtenances and a filter 23. Filter 23 comprises an annular retainer 24 and the filter material 25. The lower portion 19 of the annular retainer 24—shown in more detail in Fig. 9—is concave and silvered so that it has a dual function being a reflector and part of a filter. The function of reflector portion 19 is explained more fully in connection with the reflectors shown in Figs. 12 to 14. Material 25, as shown, comprises glass wool or yarn wound in flat nest form around the stem 26 adjacent retainer 24 which serves to give it the needed stability. In operation the filament heat sets up convection currents in the gas inside of globe 20. These currents, graphically indicated by arrows in Fig. 8, carry whatever vaporized tungsten particles escape from the filament 22 through suitable perforations 27 in retainer 24 and deposit such particles on the filter material 25. By these means the inside of globe 20 remains unsoiled because the gases coming in contact therewith have been previously cleaned by filter 23. The filter is always placed above the filament as shown in Fig. 8 with a "base-up" lamp. Even with a "base-down" lamp, a similar filter can be used although it would likely be smaller and closer to the filament.

The lamp of Fig. 10 comprises a globe 30 and a base 31. The filament 32 is supported on a stem 33 and integral with said stem is a set of spider-like arms 34 between which filter material 35 is wound. In operation the filter 36 operates precisely as does filter 25 (Fig. 8) but freer passage for convection currents is afforded by arms 34 than by reflector retainer 24 which is only perforated (Fig. 9). In assembling these filters the filter material in final position is squeezed into

the lamp and afterwards any temporary disarrangement is corrected.

40 is a globe and 41 a base on the lamp illustrated in Fig. 12. Filament 44 is supported by means of filament supports 43 and leads 45 suitably anchored in stem 42. Positioned on stem 42 adjacent filament 44 is a concave reflector 46. In the enlarged view thereof in Fig. 13, reflector 46 is shown composed of a glass base 47 and silvered surface 48. Hence the light rays originally directed toward the neck and base 41 of the lamp, comprising the non-illuminating zone or region, are redirected toward that portion of globe 40 serving as a light passing surface or illumination area. The space between such area and the filament 44 forms an illuminating zone for the purposes of this description. Naturally the better the reflector the more light is redirected and the greater the saving. In assembling reflector 46 is affixed in place over the enlarged end of stem 42.

In the modified reflector 49 shown in Fig. 14, the distance between the filament 50 and reflector 49 determines, as shown, the boundaries between illuminating zone and area and the contra state. Shifting reflector 49 on stem 51 before the lamp is assembled changes such boundaries accordingly.

This application is not limited by the theories expressed herein to explain the beneficial results obtained nor is the invention of any narrower scope than that defined by the following claims.

The subject matter described but not claimed herein is covered by my copending application S. N. 314,227 filed January 17, 1940.

I claim:

1. A drawn metallic filament having a grooved surface, said surface comprising substantially contiguous grooves and said grooves comprising side surfaces substantially forming contiguous acute angles of approximately 25 degrees.

2. A drawn metallic filament having a series of contiguous grooves running lengthwise on its surface, each of said grooves being approximately an equally angled acute angle of not less than 15 degrees and not more than 40 degrees.

3. An incandescent filament of a generally circular cross section having a series of acute angled grooves on its surface whereby filament vaporization is retarded, greater surface area is provided and multiple reflection of rays emanating from the sides of said grooves is obtained.

4. An incandescent lamp filament of a generally circular cross section having a series of grooves on its surface, the sides of each such groove forming an angle of substantially 25 degrees.

5. A filament having a series of surface grooves substantially involute in cross section around its periphery.

6. An incandescent filament having a grooved surface, said surface comprising substantially contiguous grooves and said grooves comprising side surfaces substantially forming contiguous acute angles.

7. A tungsten filament having a series of adjacent grooves running lengthwise on its surface, the sides of each such groove forming an angle of 90 degrees or less.

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