Jan. 24, 1928. 1,657,060

A. L. BECKET

INCANDESCENT ELECTRIC LAMP AND METHOD OF PRODUCING THE SAME

Filed Jan. 30, 1925

Fig. 1.

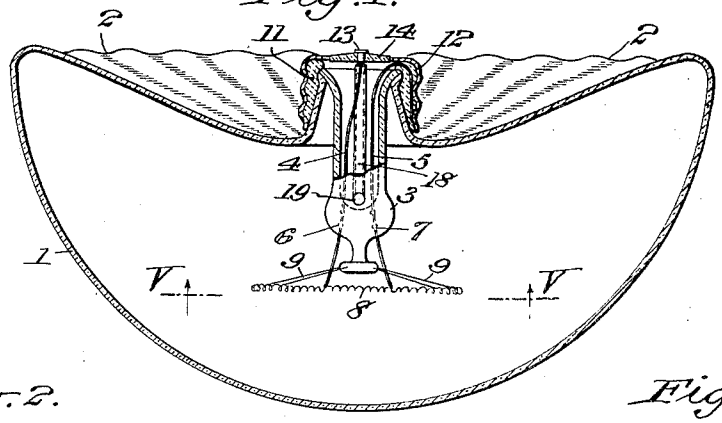


Fig. 2.

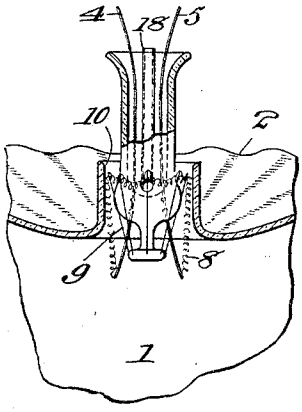


Fig. 3.

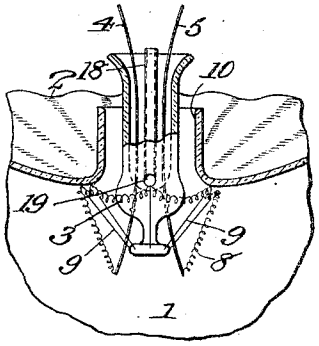


Fig. 4.

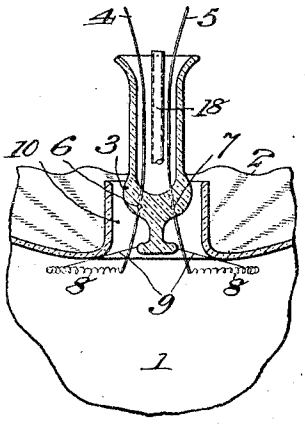


Fig. 5.

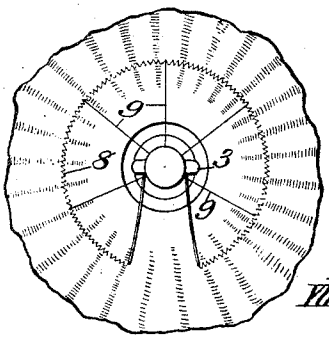


Fig. 6.

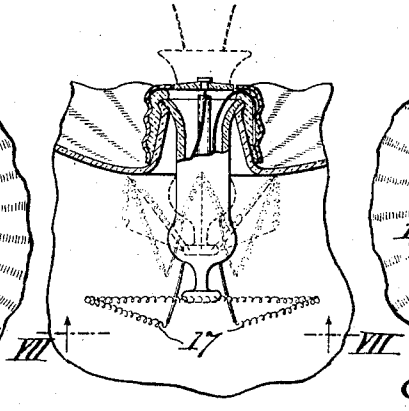
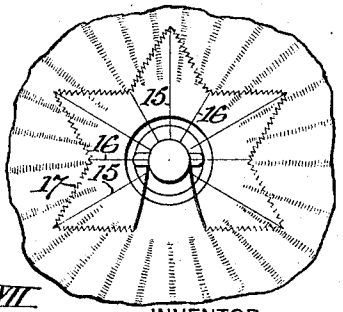


Fig. 7.



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UNITED STATES PATENT OFFICE.

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INCANDESCENT ELECTRIC LAMP AND METHOD OF PRODUCING THE SAME.

Application filed January 30, 1925. Serial No. 5,784.

This invention relates to improvements in incandescent electric lamps and has for objects to provide a construction of this character which has advantageous features with respect to illumination, diffusion of light, anti-glare, longevity, lack of vibration, convenience of packing and shipment, and appearance.

Another object consists in providing certain improvements in the form, construction and arrangement of the several parts, whereby the above named objects and advantages, as well as others, may effectively be attained.

A further object consists in providing an improved method of assembling the bulb and filament parts of the bulb.

A practical embodiment of the invention is represented in the accompanying drawings, in which

Fig. 1 represents a vertical section through the completed lamp.

Fig. 2 represents a detail section, partly in elevation, showing one of the first steps in assembling the bulb and filament.

Fig. 3 represents a similar view showing a subsequent step.

Fig. 4 represents a detail section showing a further step.

Fig. 5 represents a detail section taken in the plane of the line V—V of Fig. 1, looking in the direction of the arrows, and showing the final assembly of the filament in the bulb.

Fig. 6 represents a detail section, partly in elevation, showing a modified form; parts being shown in different positions in full and dotted lines.

Fig. 7 represents a detail section, taken in the plane of the line VII—VII of Fig. 6, looking in the direction of the arrows.

Incandescent electric lamps, as commonly manufactured, have certain disadvantages which it is highly desirable to overcome. One of these is glare or excessive brilliancy due to the great amount of light concentrated in the small filament. In the effort to reduce this disadvantage, the bulbs have been coated on the outside with more or less opaque material, but this coating very sensibly reduces the light giving power of the lamp. This is probably due to cross reflection between the walls of the coated lamp and also to increased absorption of internally reflected light rays at the base of the lamp.

Furthermore, for some reason or other, this coating of the bulb has proved to have a deleterious effect particularly with respect to shortening the life of the lamp. While the cause of this may not be definitely known, it is probably due to the internal reflection and focusing of the heat rays from the walls of the lamp upon the filament itself. These heat rays increase the temperature of the filament and thereby tend to accelerate the normal disintegration of the filament, for instance, evaporation of the tungsten material, thereby progressively reducing the efficiency and life of the filament and, hence, of the lamp.

Another method of reducing glare has consisted in etching or frosting the bulb, but this also results in the disadvantages above named and, when only the lower portion of the bulb is etched, most of the light is obliged to pass through the upper portion of the bulb where discoloration or blackening is most prevalent. This results in considerable waste of light due to absorption.

These coated, etched or frosted bulbs also leave something to be desired with respect to appearance because they are exceedingly prone to an accumulation of dust and dirt.

It might be suggested to place these coatings or etchings on the inside of the bulb so that they would be protected from dust and dirt, but this presents difficulties in manufacture. An interior treatment of this kind must be applied to the bulb before the filament is assembled therewith, and such treatment renders the bulb opaque to such an extent that it is very difficult, if not impossible, to see and inspect the filament as it is being assembled within the bulb. This is an important disadvantage since the proper location and assembly of the filament with the bulb is, of course, of the essence of a satisfactory product.

Again, the customary form of bulb allows for a substantial amount of vibration which quite frequently ruptures the filament and, in any event, greatly lessens the efficiency and shortens the life of the lamp. Such vibrations are an extremely serious problem in connection with the illumination of railways and, especially, subways and the like.

In all the usual types of bulb, whether coated or not, the upper portion of the bulb is extremely inefficient and has a marked tendency to become discolored or blackened through continued use. It is very inefficient, in so far as proper light giving qualities are considered.

Again, the extreme concentration of the light in the filament adjacent to or substantially in line with the base of the lamp has a tendency to increase the disadvantage of glare because of the contrast between the filament and the base, this factor of contrast being very important in the matter of glare.

My structure has been designed to overcome these disadvantages, and other disadvantages inherent in the present type of lamp, and to obtain certain other desired features.

Referring to Figs. 1 to 5 inclusive of the drawings, the bulb of the lamp is denoted by 1, and it may be formed of glass or other suitable material in any well known or approved manner of manufacture.

The main portion of the bulb is preferably formed substantially hemispherical in shape, and its top is depressed so as to form a re-entrant portion within the bulb proper. This top is preferably formed on a parabolic curve, as indicated in Fig. 1, and it may also have corrugations formed therein in any suitable direction, such as circumferential or radial, the latter form being shown in the present instance and marked 2.

These corrugations tend to increase the reflecting capacity of the top and they also enlarge the radiating surface so as to tend to reduce the heat within the lamp.

The outside of the said top is desirably coated with some approved reflecting medium, such as mercury or paint, and it will be observed that such coating is not subject to the disadvantage resulting from accumulation of dust and dirt, because it is located in a position substantially out of sight.

The arrangement of this top, and its shape, serve to provide a very efficient reflecting surface that pronouncedly diffuses the intense light in the filament and, at the same time, increases the lighting capacity of the lamp. This reflector, instead of focusing the heat rays upon the filament, therefore, has the opposite effect of dispersing them. Again, this shape of bulb and arrangement of reflector does not generate the cross reflections referred to in connection with the coated or etched bulbs of ordinary construction, and thus does not decrease or absorb the light produced by the filament.

Furthermore, the reflecting surface adjacent the base of the lamp removes the ordinary disadvantage of contrast between base and filament and thereby greatly lessens the contrast factor as promoting glare. The effect of this reflector is that of increasing the size of the apparent light source and thus minimizing the glare from the filament.

Finally, the reflector, being formed as a unitary part of the bulb, is dust-proof on its reflecting surface and therefore eliminates the cost of maintenance necessary with the usual lighting systems in which separate reflectors are employed.

The stem for carrying the filament is marked 3 and it may be of any well known or approved form.

The lead-in wires 4, 5 are made fast in the stem in the usual way, as indicated at 6, 7, and their ends are connected to a filament 8 of tungsten or other suitable material. This arrangement is well understood in the art.

Anchoring members in the form of small wires 9 have their inner ends fixed in the extremity of the stem 3, and their outer ends fast to the filament. These anchoring members are preferably composed of some readily bendable metal, such as is commonly employed for the purpose of supporting filaments in this class of lamps. Their ends are inserted in the stem 3 so that the anchoring members project upwardly at an angle as illustrated in Fig. 2.

When the stem and parts just described have been assembled into a unit, the whole is inserted within the bulb 1 until the anchoring members and filament have passed entirely through the neck portion 10 thereof. As soon as this position is reached, the slight resiliency of the anchoring members and filament will cause a certain amount of expansion thereof into the position represented in Fig. 3. The operator now pulls upwardly on the stem 3 until it has been elevated, as shown in Fig. 4. This motion causes the contact between the top of the bulb 1 and the anchoring members 9 to spread out the latter into substantially right angular position with respect to the axis of the stem, and thereby distend the filament into practically circular form, as represented in Fig. 5. Following this, the operator again inserts the stem further within the bulb and these parts are fused together into the assembly shown in Fig. 1, in a manner well understood in the art. Following this, the usual base is secured to the bulb, in any well known or approved manner as, for instance, by a layer of cement 11 located between the threaded metallic sleeve 12, which constitutes the base, and the exterior of the neck 10.

In case the resiliency of the anchoring members is not sufficient to cause the expansion thereof into the position represented in Fig. 3, the result above named may be accomplished by merely moving the stem 3 to one side of the neck of the bulb and then lifting the stem up so as to spread out part of the anchoring members, after which the operation may be repeated with the stem in

contact with one or more other parts of the neck of the bulb until all the anchoring members have been spread out as indicated, to the desired position.

In the customary way, also, the lead-in wire 5 is soldered to the sleeve 12, to form one contact; and the lead-in wire 4 is connected to a metallic contact 13 that is set in an insulating button 14, which may be composed of glass or other suitable material, and is carried by the sleeve 12. This construction and operation are also well known in this industry.

The lamp is now complete and may be screwed into a socket and employed in an obvious manner.

The construction of the filament and its supports, and the method of assembling the same with the bulb, enables the provision of a very distended filament in the completed lamp because, after contracting the size of the filament by the angle of the anchoring members, as shown in Fig. 2, the positive contact of the said anchoring members and filament with the top of the bulb in the outward movement of the stem, represented in Figs. 3 and 4, serves forcibly to expand the filament to the full extent of the anchoring members, an operation which could not take place if reliance were had simply upon the natural resiliency of the filament, such as tungsten. This distended filament not only greatly assists in diffusing the light and reducing glare, but it also increases the distance of the filament from the stem and base thereby reducing the chance of unduly heating the stem and causing the objectionable arcing between the sealed lead-in wires and the further danger of affecting the base cement.

It will be seen that, if desired, the interior of the main portion 1 of the bulb may be coated or etched before the filament is inserted therein and yet the operator will have a full view of the filament while locating it within the bulb because he can clearly see through the top of the bulb owing to its shape and location with respect to the filament. In such cases, the coating of reflecting material, such as mercury, will not be placed on the top of the bulb until after the filament has been inserted.

By coating or etching the lower half of the main portion of the bulb embodying my invention, and leaving the upper half of the main portion clear, a remarkably uniform distribution of light is obtained. The direct rays of the filament are diffused by the coating or etching and practically all of the reflected light will then pass through the clear portion of the bulb which gives a very efficient and pleasing illumination.

This form of lamp is, as will be seen, very compact and, because of the relatively short axial length, not at all prone to vibrate, which renders it especially valuable for use in subway trains and the like where vibratory forces are almost continuously at work.

Again, the shape of the lamp enables it to be fitted in sockets in such manner as to practically entirely, if not entirely, exclude the base and socket from sight, thereby greatly improving the appearance of lighting fixtures, which is an extremely important commercial consideration. To this end, the top of the bulb is preferably caused to re-enter the bulb proper a sufficient distance so that the outer rim of the neck portion or outer end of the base, as it may be called, is substantially flush with the top edge of the bulb. However, it may, in certain cases, be desirable to have the base extend slightly above the upper rim of the bulb so as to facilitate the application of the lamp to sockets which do not protrude from their supports. These are commonly called flush sockets.

The compactness of this lamp lends markedly to its shipping qualities because it may be packed in much smaller space than the ordinary lamp and with much less liability of breakage.

Referring to the modified form shown in Figs. 6 and 7, it will be seen that the parts are the same except that the anchoring members for the filament, here marked 15, 16, vary in length so as to give the filament, here marked 17, an angular formation, thereby increasing its length and effective light producing qualities. It will be clear that these forms of filament may be varied to a great extent by simply changing the lengths and arrangement of the anchoring members. In other respects, this modified form in Figs. 6 and 7 is the same as the preferred form and the method of assembling the parts is also the same. Comparison of the dotted and full line positions shown in Fig. 6 sufficiently indicates the steps followed in assembling the parts, since the same have been fully described in connection with the preferred form.

Referring to both forms, it will be seen that the usual tube or duct 18 is fixed in the stem 3 with one end opening into the bulb, as indicated at 19, and the other end opening at the outer end of the stem. This tube is for the purpose of exhausting the air from the bulb when a vacuum lamp is to be made and for exhausting air and injecting gas when a gas lamp is to be made. In either case, the outer end of the tube 18 is sealed, in the usual way, when its function has been performed. It may be stated, at this juncture, that my invention has especial features of advantage when employed in the manufacture of gas filled lamps, more particularly with respect to the matter of blackening at certain portions because of convection currents.

Again referring to both forms, it should

be mentioned that the shape of my improved bulb is such as very largely, if not entirely, to eliminate the blackening which commonly takes place in the upper part of the ordinary bulb due to the particles of the filament (tungsten) which accumulate there. In the ordinary bulb, the upper portion is comparatively small and, by virtue of its shape, facilitates the congregation of the tungsten particles into a very objectionable discoloration. In my form of bulb, on the other hand, the upper surface is very large and, by reason of its shape, tends to cause the particles of tungsten to seek the groove at the union of the top and body portion and to congregate there. This groove constitutes, and may be defined as, a circumspatial chamber which surrounds the base and filament at a distance therefrom. The accumulation of these particles at this point has very little, if any, effect by way of lessening the efficiency of the light. Even if the tungsten should be deposited throughout the upper surface of my bulb, its deleterious effect would be comparatively slight owing to the extended area of this surface.

The present invention provides a means of dispersing the convection currents rising from the filament and diverting them away from the base and stem seal; thus reducing the likelihood of over-heating and damaging the said parts. This is accomplished by providing the chamber, which I call a circumspatial chamber, located at some distance away from and higher than the base and seal. The convection currents seek this chamber in accordance with the laws of convection instead of concentrating around the base and seal as in the ordinary shape of gas filled lamp.

The blackening in gas filled lamps is generally understood to be distributed on the glass by the convection currents which, rising from the hot filament, carry with them particles of tungsten, which particles are deposited where the currents first come in contact with the inner surface of the bulb. This is generally near the upper portion of the bulb. I have discovered that the convection currents circulate at a rapid pace around the inside surface of the lamp and that they have a washing or scrubbing effect thereupon; so that the reason for the accumulation of the blackening in the upper portion of the gas filled lamps is because, at this point, the washing effect of the circulating currents is less powerful than at other places in the lamp. Where the bulb has a sudden change of direction, the currents move somewhat slowly, and are turned in their course in such a way as to counteract each other and to neutralize their force, thereby facilitating the deposit of particles of blackening material at this particular place. On the other hand where the bulb has a wide, free sweep, as in the lower rounded portion, the currents travel at a high rate and their scrubbing action is effective.

The present lamp is so designed as to provide a circumspatial chamber in the form of a groove between the upper and lower parts of the bulb, which is calculated to draw the convection currents toward it and to thereby relieve the base and stem seal from excessive heat and cause the particles of blackening material to accumulate in the said groove or circumspatial chamber instead of depositing upon the light transmitting portion of the bulb.

Further referring to both forms, it will be understood that various changes may be resorted to in the form, construction, material and arrangement of the several parts and in the steps followed in assembling the parts, without departing from the spirit and scope of my invention, and, hence, I do not intend to be limited to the details herein shown and described, except as they may be included in the claims.

What I claim is:

1. An incandescent electric lamp comprising, a bulb having a substantially hemispherical portion and a parabolic portion, the latter portion being re-entrant within the former, a base on the parabolic portion lying substantially within the hemispherical portion, and a filament secured to the base and lying below the lowermost part of the parabolic portion, the convex side of the parabolic portion being adjacent the filament.

2. A method of producing an incandescent electric lamp by the use of a bulb with an open base and an expansible filament support, which includes, inserting the filament support through the open base within the bulb, and bringing the filament support in contact with the bulb for expanding it.

3. A method of producing an incandescent electric lamp by the use of a bulb with an open base and an expansible filament support, which includes, inserting the filament, support through the open base within the bulb, bringing the filament support in contact with the bulb for expanding it, and sealing the filament support within the bulb.

4. A method of producing an incandescent electric lamp by the use of a bulb with an open base and a stem, which includes, inserting filament anchoring members in the stem at an acute angle to its axis, supporting a filament on said anchoring members, inserting the stem and connected parts through the base into the bulb, and moving the stem so as to bring the extremities of said anchoring members in contact with the bulb and thereby bend them into a substantially right angular relationship with respect to the axis of the stem.

5. A method of producing an incandescent electric lamp by the use of a bulb with an open base and a stem, which includes, inserting filament anchoring members in the stem at an ancute angle to its axis, supporting a filament on said anchoring members, inserting the stem and connected parts through the base into the bulb, moving the stem so as to bring the extremities of said anchoring members in contact with the bulb and thereby bend them into a substantially right angular relationship with respect to the axis of the stem, and sealing the stem within the bulb.

6. An incandescent gas filled electric lamp, having a circumspatial chamber adapted to collect heat currents given off by the filament.

7. An incandescent gas filled electric lamp, having a circumspatial chamber adapted to collect blackening given off by the filament.

8. An incandescent gas filled electric lamp, having a circumspatial chamber adapted to collect heat currents and blackening given off by the filament.

9. An incandescent gas filled electric lamp comprising, a base, lead-in wires and a coiled filament attached thereto, said lamp having a circumspatial chamber.

10. An incandescent gas filled electric lamp, said lamp having a filament therein and being provided with a chamber surrounding the filament and so formed as to collect the heat currents and blackening given off by the filament.

11. An incandescent gas filled electric lamp so formed as to collect in one portion thereof heat currents and blackening given off by the filament whereby the injurious effect of the blackening on the light transmitting portion of the bulb is retarded.

12. An incandescent gas filled electric lamp comprising, a lower portion, an upper portion, and an intermediate portion, the intermediate portion being so formed as to constitute a rounded groove connecting the upper and lower portions.

In testimony, that I claim the foregoing as my invention, I have signed my name this 27th day of January, 1925.

ALAN L. BECKET.